VOICE SWITCHING AND CONTROL SYSTEM
TRAINING AND BACKUP SWITCH (VTABS)
SPECIFICATION

FAA-E-2914

SCN-PSR-003 05 August 1998

15 JANUARY 1997

REVISION: -

DEPARTMENT OF TRANSPORTATION

FEDERAL AVIATION ADMINISTRATION

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Approved by: _____ Date: 2/7/97
John McKenna, AUA-200, En Route
Integrated Product Team Lead (IPTL)

Approved by: _____ Date: 2/7/97
Michael Shveda, AUA-250, VSCS
Product Team Lead (PTL)

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VOICE SWITCHING AND CONTROL SYSTEM TRAINING AND BACKUP SWITCH (VTABS) SPECIFICATION

1.0 INTRODUCTION

1.1 SCOPE

This specification provides a description of the engineering and design requirements of the Voice Switching and Control System (VSCS) Training and Backup Switch (VTABS) for installation in the National Airspace System (NAS). Included in this document are the VTABS requirements for functionality, operational performance, hardware, construction, software, testing, and quality assurance.

At the direction of the Government, the requirements of this VTABS product specification, modified as per Addendum 1, shall be applicable to the VTABS.

1.1.1 Overview

VTABS is a stand-alone voice communication switch for Enroute Radar training and an independent hot backup communication switch for critical ATC sectors A/G and G/G communications.

As the modernization of the FAA's Air Route Traffic Control Centers (ARTCCs) is implemented by the VSCS program, two additional requirements have evolved: 1) a full fidelity training system and 2) an independent hot backup system for critical A/G communications. The VTABS will provide air traffic controllers with a realistic voice communication training system for use with DYSIM, and the ability to control air traffic via provision of critical A/G and G/G communications resources (up to the system maximum configuration) in the event of a VSCS system failure), or unscheduled outage (power failure, critical software failure, or during hardware or software maintenance.

The VTABS will provide a Position Electronics Module (PEM) (used as a backup to the VSCS Electronics Module (VEM)) for interfacing the VSCS entry devices to the VTABS switching subsystem for voice communications on each critical VSCS position. In the event of a VSCS failure or scheduled outage, the VTABS will transition position entry devices from the VEM to the VTABS PEM on command. Following completion of the switchover from the VSCS to the VTABS backup switching subsystem, each critical air traffic controller position will be provided A/G and G/G communication capabilities functionally equivalent to VSCS.

The VTABS will be capable of being reconfigured to perform different functions under a changing ATC environment. Therefore, specific displays and connectivities of the VTABS will be under programmable control.

1.1.2 VTABS Description

The VTABS is a computer controlled voice switching system that provides Air-to-Ground (A/G) and Ground-to-Ground (G/G) operations. The VTABS will provide two fully independent switching subsystems, one for training and one for the VSCS backup. There is no communication or control resource sharing between the Backup and Training subsystems.

1.1.2.1 VTABS Backup Subsystem Description - The VTABS Backup subsystem will have the capability of being configured with up to 50 critical positions, 16 analog telephones (provides G/G IC communications), 126 G/G trunks, and 190 A/G frequencies. The Backup subsystem equipment will be provided with battery backup to allow full system operations in the event of a critical power failure at the facility.

The VTABS Backup subsystem interfaces to the facility critical A/G frequency and G/G trunk resources via the existing Transition Switch subsystem provided with the VSCS. All critical frequencies and trunks defined by the facility will be configured in the VTABS switching subsystem (up to the system limits). Each critical ATC position defined will be configured with the VTABS PEMs. The VTABS position electronics module will be interfaced to the existing position entry devices via a dedicated A/B switch module.

The Backup subsystem will provide near instantaneous availability to critical A/G and G/G communications circuits for each critical position configured with a VTABS PEM. In the event a catastrophic VSCS system failure occurs, or the VSCS is required to be taken off-line for other reasons, the Backup subsystem can be instantaneously put on-line via a single bulk transfer function. Following switchover from VSCS to VTABS via the VSCS Transition Switch, designated critical positions will have communications capability over the critical frequencies and trunks mapped in the active VTABS database.

The VTABS will sustain A/G and G/G functionality in the event of a facility critical power failure via the critical communications resources until critical power is restored, or until the VTABS backup battery life is exceeded (twenty minutes). Following restoration of the VSCS to an operational state, the critical position, frequency, and trunk resources can be transitioned back to VSCS via a single bulk transfer function.

VTABS will permit legal recording of all A/G frequencies and G/G circuits via Government provided legal recorders.

1.1.2.2 VTABS Training Subsystem Description - The VTABS Training subsystem will have the capability of being configured with up to 24 Student positions, 24 Pilot positions, 16 Instructor positions, 156 G/G trunks, 254 A/G frequencies, 24 supervisory recorders, and one Master Instructor position in a maximum system configuration. The Training subsystem will use the same map-driven configuration and connectivity concept as the Backup subsystem. Under control of the Master Instructor, the Training subsystem will provide the configuration flexibility to meet a variety of training needs by downloading different position and switch maps. By changing configuration maps, system resources can be assigned to a single control sector or multiple control sectors. When multiple control sectors are configured, they can be identical or different. Some features and functions will be unique to the training environment such as duplicate resource labeling and calling party ID. Features which are not applicable to the Backup subsystem are not classmarked for assignment in the Backup subsystem. The Training subsystem and the Backup subsystems are completely independent. Training scenarios continue regardless of the Backup subsystem status. Reconfiguration of either subsystem is independent of the other subsystem.

1.1.2.3 VTABS Position Description - Both the Training and Backup subsystems will utilize the VTABS PEM for interfacing the entry devices to the switching subsystems. The PEM will provide equivalent ATC functionality to the VSCS VEM. The identical Computer Human Interface (CHI) operations and feedback to the operator will be provided through the GFE peripheral devices listed below:

- Both Display Modules (VDMs);
- Both Dual Jack Modules (DJMs);
- The foot switch;
- Both loudspeakers;
- and The VSCS IA Keypad (VIK).

The VTABS Training subsystem position entry devices are always connected to the PEM. The VTABS Backup subsystem position entry devices are shared with the VSCS. In the hot standby mode, the entry devices will be connected to the VSCS VEM. Following VSCS to VTABS switchover, the position entry devices are switched over to the VTABS PEM chassis which will provide voice communication through the VTABS Backup subsystem. VSCS to VTABS switchover will not require any controller actions to initiate the transition. Following switchover to the VTABS system, the critical ATC position operator will be capable of selecting the desired A/G frequencies and G/G IC/IP circuits and activation of the PTT switch to initiate voice communication over critical voice circuits.

Each PEM will be split mode capable (provides for simultaneous A/G and G/G position operations at a single position).

1.1.2.4 VTABS Switching and Control Subsystem Description - VTABS uses a common hardware platform and software architecture for both the Backup and Training subsystems. The VTABS Backup and Training subsystems will be equipped with separate control subsystems for independent centralized equipment status monitor and control functions, the reconfiguration functions, system initialization functions, and the system administration functions. The CHI to support each of these functions will be provided by dedicated workstations connected to the control subsystem via a dedicated local area network (LAN). In both the VTABS Backup and Training subsystems, the DEO, Maintenance, and Supervisory CHI functions will be accessible from a single workstation or from any workstation connected to the independent control subsystem. Access to specific functions will be determined by user log-on, password, and classmarks. The Training subsystem will also support a Master Instructor user log-on workstation which will provide a combination of the supervisor, maintainer, and DEO functionality.

1.1.2.5 VTABS ATC Operations - ATC personnel will use the VTABS as follows:

a. Air-to-Ground (A/G) radio: Controllers will use the VTABS to access and provide proper control of the remote ultra high frequency (UHF)/very high frequency (VHF) A/G transmitters and receivers to communicate with pilots. The VTABS will also ensure that incoming A/G communications are routed to the appropriate controller position. Connectivity to the Backup Emergency Communications (BUEC) will be provided for critical frequencies configured for BUEC in the VTABS Backup Subsystem.

b. Intercom: Through the VTABS, ATC personnel within an ARTCC will be able to access other critical control positions or ancillary positions equipped with the VTABS position electronics modules located within that ARTCC.

c. Interphone: Critical ATC personnel at an ARTCC will be able to access positions located within another ATC facility via critical trunks configured in the VTABS switching subsystem.

1.2 DOCUMENT ORGANIZATION

This document is the product specification for the VTABS. Contained herein are the requirements for both the Training and Backup subsystems.

2.0 APPLICABLE DOCUMENTS

2.1 GENERAL

The following FAA specifications, standards, drawings, and NAS configuration management documents listed in the various categories defined below form a part of this specification and are applicable to the extent described in this document. The correct version of the documents referenced in this specification will be stated in the contract.

2.2 FAA DOCUMENTS

2.2.1 FAA Specifications

Document	Title
FAA-C-1217E	Electrical Work, Interior
FAA-G-2100F	Electronic Equipment General Requirements
FAA-E-2290C	Control Equipment, Radio Channel
FAA-D-2494/b	Technical Instruction Book Manuscript; Electronic, electrical, and Mechanical Equipment, Requirements for Preparation of Books

2.2.2 FAA Standards

Document	Title
FAA-STD-019B	Lightning Protection, Grounding, Bonding, and Shielding Requirements for Facilities
FAA-STD-020B	Transient Protection, Grounding, Bonding, and Shielding Requirements for Equipment
FAA-STD-028	Contract Training Programs

2.2.3 Other FAA Documents

Document	Title
NAS-IR-61004201	ACF-VSCS
NAS-IR-64024201	VSCS-BUEC IRD
NAS-IR-42009404	VSCS-PABX IRD
NAS-IR-42004205	VSCS-REC IRD
NAS-IR-80104201	VSCS-Power IRD
VS-I-01	VSCS-TRUNKS ICD
VS-I-03	VSCS-Existing Radios ICD

NAS-IR-44010002	TRANSMISSION EQUIPMENT: ANALOG INTERFACE IRD
FAA Order 1600.54	Security of FAA Automatic Data Processing Systems and Facilities
FAA Order 6650.9	Requirements for Area Control Facility (ACF) Under the Floor Cabling
FSD/VSCS-WP-001.2	VSCS Distribution Frame and Radio Interface Intermediate Distribution Frame Top Level Design
FAA Order 1810.4b	FAA NAS Test and Evaluation Program
FAA Order 6950.2c	Electrical Power Policy Implementation of National Airspace System Facilities
FAA Order 1810.6	Policy For Use On Non-Developmental Items In FAA Acquisitions
FAA Order 6000.15	General Maintenance Handbook For Airways Facilities, August 1991
FAA Order 6000.75b	General Maintenance Handbook for Airway Facilities
FAA Order 6000.30b	Policy for the Maintenance of the National Airspace System through Year 2000
VP 41 (179654)*	VSCS to Backup Emergency Communication Interface Control Document for the Voice Switching and Control System (VSCS)
VP 41 (179667)*	VSCS to Existing Radio Interface Control Document for the Voice Switching and Control System (VSCS).
VP 41 (179656)*	VSCS to the Trunks Interface Control Document for the Voice Switching and Control System (VSCS).
VP 41 (179655)*	VSCS to the Private Automatic Branch Exchange Interface Control Document for the Voice Switching and Control System (VSCS).
VP 41 (210595)*	VSCS to the Transmission Equipment (Analog Interface) Interface Control Document for the Voice Switching and Control System (VSCS).
VP 41 (179659)*	VSCS to AC Power Supply Interface Control Document for the Voice Switching and Control System (VSCS).
VP 41 (187340)*	VSCS to the Coded Time Source Interface Control Document for the Voice Switching and Control System (VSCS).
VP 41 (179657)*	VSCS to Recording Equipment (Magnetic Tape) Interface Control Document for the Voice Switching and Control System (VSCS).
VP 46	Human Factors Design Document

* These numbers refer to CDRLs delivered by the Harris Corporation as part of their VSCS implementation. The numbers in the parenthesis refer to the corresponding Harris document numbers.

2.3 MILITARY PUBLICATIONS

2.3.1 Military Specifications

Document	Title
MIL-E-17555	Electronic and Electrical Equipment, Accessories, and Repair Parts, Packaging and Packing of

2.3.2 Military Standards

Document	Title
MIL-STD-454	Standard General Requirements for Electronic Equipment
MIL-STD-461D	Electromagnetic Emission and Susceptibility Requirements
MIL-STD-462D	Electromagnetic Interference's Characteristics, Measurement of MIL-STD-810E, Environmental Test Methods and Engineering Guidelines
MIL-STD-810E	Environmental Test Methods and Engineering Guidelines
MIL-STD-882	System Safety Program Requirements

2.4 AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI) STANDARDS

Document	Title
ANSI IPC-T-50	Terms and Definitions for Interconnecting and Packaging Electronics Circuits
ANSI IPC-A-610	Acceptability of Printed Board Assemblies
ANSI S3.3-1989	Method for Measuring the Intelligibility of Speech Over Communications Systems

2.5 INDUSTRY STANDARDS

Document	Title
EIA/TIA-464A	Private Branch Exchange (PBX) Switching Equipment for Voiceband Application
IEEE-STD-823-1989	IEEE Standard Methodologies for Specifying Voice grade Channel Transmission Parameters and Evaluating Connection Transmission Performance for Speech Telephony
IEC 801-2	Electrostatic Discharge Requirements, Susceptibility
NFPA-70	National Electrical Code D1996

ANSI/ASQC Q 9001 - 1994	Quality Systems - Model for Quality Assurance in Design, Development, Production, Installation and Servicing.
SO-9000-3	Quality Management and Quality Assurance Standards - Part-3: Guidelines for the application of ISO 9001 to the development, supply and maintenance of software.

2.6 FEDERAL STANDARDS

Document	Title
29 CFR 1910	OSHA Safety and Health Standard

2.7 RESERVED

2.8 DOCUMENT PRECEDENCE

When conflicts exist between the requirements of the contract and this specification, the contract shall take precedence. When conflicts exist between the requirements of this specification and its referenced documents, this specification shall take precedence. When the requirements of the U.S. Government Printing Office Style Manual conflict with the requirements (a) specified herein, or (b) in any other applicable FAA standards, requirements of this specification and other FAA specifications shall apply.

2.9 DOCUMENT SOURCES

Copies of this specification and other applicable FAA specifications, standards and drawings may be obtained from the FAA Contracting Officer. Requests should fully identify material desired, i.e., specification, standard, amendment, and drawing numbers. Requests should cite the invitation for bids, request for proposals, the contract involved, or other use to be made of the requested material.

Single copies of applicable federal and military specifications, standards, and drawings may be obtained by ordering through the Naval Publications and Forms Center (NPFC), Philadelphia, which is the Department of Defense Single Stock Print (DOD-SSP) and distribution center for unclassified specifications and standards. Documents may be ordered by writing: Naval Publications and Forms Center, Customer Service Department, Code 1052, 5801 Tabor Avenue, Philadelphia, Pennsylvania 19120; or calling (215) 697-3321, Monday through Friday, from 8 a.m. to 4:30 p.m. (Eastern time).

Information on obtaining copies of the National Electrical Code may be obtained from the National Fire Protection Association, Batterymarch Park, Quincy, Massachusetts 02269.

Information on obtaining copies of the Metric Practice Guide may be obtained from the American National Standards Institute, Incorporated, 1430 Broadway, New York, New York 10018.

ANSI/ASQC-Q-9001-1994 and ISO 9000-3 can be obtained from the following source: American Society For Quality Control, 611 East Wisconsin Avenue, P.O. Box 3005, Milwaukee, Wisconsin 53201-3005.

3.0 REQUIREMENTS

3.1 GENERAL REQUIREMENTS

The VTABS shall be developed, fabricated, tested, delivered, installed, integrated, with a GFE transition switch, and made fully operational in accordance with this specification and the contract schedule.

3.1.1 Definitions and Formulas

The definitions and related mathematical formulas for terms used herein shall be in accordance with Appendix I, Acronyms, Abbreviations, Definitions, Terms, and Formulas.

3.1.1.1 System Design and Construction - The VTABS shall be designed and constructed using proven state-of-the-art computer, switching, and software technologies. Where possible, all hardware and computer operating systems shall be commercially available, or enhanced/modified from existing systems currently in operation (in a FAA, DOD, or commercial application) as required to meet the requirements specified in this document.

3.1.2 VTABS Requirements

The VTABS shall provide the position equipment (excluding VCE peripherals), control system equipment, and voice switching equipment necessary to provide an independent ATC communications backup to the VSCS, and an independent Training subsystem to meet ATC controller training requirements within each ARTCC.

The VTABS Training and Backup subsystems shall be functionally independent. The VTABS shall permit simultaneous and independent operation of the Backup subsystem and Training subsystems. Operational positions on either the Training or Backup subsystem shall be capable of placing calls or receiving calls, with no impact to operational positions, frequencies, or trunks on the other subsystem. The VTABS shall not permit any actions initiated on the Training subsystem's positions, trunk, frequencies, or workstations (including DEO operations, Reconfigurations, or Maintenance actions) to affect operations on the Backup subsystem. Conversely, the VTABS shall not permit actions on the Backup subsystem to affect the Training subsystem; and neither subsystem shall affect the operation of the VSCS.

The VTABS shall not cause unexpected or false operations at any operational VSCS position, supervisory position, maintenance position, radio interface, or trunk interface due to procedures being performed at any VTABS operational position, supervisory position, maintenance position, radio interface, or trunk interface.

3.1.2.1 VTABS Size and Capacity Requirements - The VTABS shall meet the following system size and capacity requirements.

3.1.2.1.1 Number and Type of Positions - The VTABS Training subsystem shall support up to 24 Student Positions, 24 Pilot Positions, 1 Master Instructor Position, and 16 Instructor Positions via analog telephone devices. The VTABS Backup subsystem shall support up to 50 positions. The VTABS Backup subsystem shall permit any position to be assigned as a sector ATC position type (Radar, Data, Tracker, Coordinator, or Assistant), an area supervisor position, or an Ancillary position type (NAS Operations Manager, Area Manager, Maintainer, etc.).

The VTABS shall provide the capability to define and modify ATC and ancillary positions through the site adaptation data. Position names, labels and abbreviations (e.g., DA labels, CHI display and entry) shall also be adaptable. The maximum quantity of ATC positions associated with a sector which can be defined by VTABS shall be four.

The VTABS shall permit all Backup subsystem positions to be operated in split mode with an interface to the existing legal recorder channels for each position.

3.1.2.1.2 Number and Type of A/G Interfaces - Each A/G frequency interface in the VTABS Training and Backup switches shall support the following:

a. Receive only with single (main) receiver;
b. Receive only with main and standby receivers (requiring main/standby transfer capability);
c. Transmit and receive with single (main) transmitter and receiver; and,
d. Transmit and receive with main and standby transmitters and receivers (requiring main/standby transfer capability).

In addition to the above, the VTABS shall accommodate paired frequencies, in which UHF and VHF equipment are operated from the same control circuits and audio lines.

3.1.2.1.2.1 VTABS Training Subsystem A/G Radio Interfaces - The VTABS Training Subsystem shall provide interfaces for up to 254 A/G frequencies in a maximum system configuration. Each frequency radio interface shall be configured with radio interface equipment that can be looped back to provide up to 127 A/G frequency pairs that can be used for ATC controller training simulations. The loop backs shall be made within the VTABS interconnect subsystem.

3.1.2.1.2.2 VTABS Backup Subsystem A/G Radio Interfaces - The VTABS Backup subsystem shall provide for up to 190 A/G frequencies. Each of the 190 A/G frequency channels in the VTABS Backup subsystem configuration shall be capable of being configured with the radio interface equipment required for either radio interface types defined in the VSCS-to-Existing Radio ICD or as a BUEC for another frequency within the switch configuration.

3.1.2.1.3 Number and Types of G/G Circuits

3.1.2.1.3.1 VTABS Training Subsystem G/G Interfaces - The VTABS Training Subsystem shall provide G/G trunk interfaces for up to 156 trunk circuits. Each G/G trunk interface shall be configured with trunk interfaces equipment that can be looped back to provide up to 78 G/G trunk pairs that can be used for ATC controller training simulations. The loop backs shall be made within the VTABS interconnect subsystem.

3.1.2.1.3.2 VTABS Backup Subsystem G/G Interfaces - The VTABS Backup subsystem shall provide interfaces for up to 126 G/G trunk circuits. Each circuit shall be capable of being configured for any trunk type specified within the VSCS-to-Trunks ICD and the Harris VSCS-to-Trunk ICD.

3.1.2.2 VTABS Position Types

3.1.2.2.1 VTABS Backup Subsystem Operational Positions

3.1.2.2.1.1 VTABS Backup Subsystem ATC Positions - The VTABS Backup subsystem shall provide each critical VSCS ATC position (up to the system maximum) with PEMs to interface and control the display and entry devices. Each critical ATC position shall be capable of performing A/G and G/G communications functions via the display and entry devices through the VTABS Backup switching subsystem following switchover from the VSCS.

3.1.2.2.1.2 VTABS Backup Subsystem Supervisory Position - The VTABS shall provide the capability for the supervisory function to monitor and control configuration classmarks of each position via a dedicated workstation. Each supervisory position configured with a workstation shall be provided a local printer interface. The number of supervisory position workstations will be defined at the time of site survey.

3.1.2.2.1.3 VTABS Backup Subsystem Maintenance Position - The VTABS shall provide a dedicated maintenance position equipped with a workstation, a Backup subsystem PEM, and the GFE display and entry devices required to allow the position operator to communicate with the backup switching equipment at all times. The maintenance position's equipment shall be capable of being used to support maintenance actions and certifications of the VTABS backup switch equipment when operating in the standby mode (not operational). The maintenance position shall be capable of performing A/G and G/G communications functions via the display and entry devices through the VTABS Backup subsystem. The VTABS maintenance position shall provide a dedicated interface to FAA Legal recorder equipment. The VTABS shall provide status, monitor, and control capability to the maintenance position workstation. The maintenance position workstation shall be provided a local printer interface. The maintenance position operator shall have the capability to reconfigure any position A/G and G/G resources and classmarks via the maintenance position workstation. The Maintenance position reconfiguration capability shall be controlled via classmarks.

3.1.2.2.1.4 VTABS Backup Subsystem Data Entry Operator Position - The VTABS Backup subsystem shall provide a dedicated Data Entry Operator (DEO) position workstation to support system configuration map build and other system configuration functions. The DEO position shall be provided a local printer interface.

3.1.2.2.1.5 VTABS Backup Subsystem NAS Manager Position - The VTABS shall provide status, monitor, and control capability to the NAS manager position via a dedicated workstation. The NAS Manager position shall be provided a local printer interface. The NAS Manager position operator shall have the capability to reconfigure any position A/G and G/G resources and classmarks via the NAS Manager position workstation. In addition to the workstation, the VTABS shall provide the capability to configure the NAS manager position with a backup PEM to support A/G and G/G communications following switchover from VSCS. NAS Manager position reconfiguration capability shall be controlled via user logon, password and classmarks.

3.1.2.2.1.6 VTABS Backup Subsystem Ancillary Position - The VTABS Backup subsystem shall be capable of being configured to support other ancillary positions types deemed critical by the facility (up to the system maximum). Each position shall be capable of A/G and G/G communications, and shall be provided with workstations for monitoring system status as defined by the position type and classmarks. Each ancillary position configured with a workstation shall be provided a local printer interface.

3.1.2.2.1.7 Reserved

3.1.2.2.2 VTABS Training Subsystem Position Types

3.1.2.2.2.1 VTABS Training Subsystem ATC Positions - The VTABS Training subsystem shall provide each DYSIM ATC training position (up to the system maximum) with the VTABS PEM, and display and entry devices for performing A/G and G/G communications training scenarios, and position functions via the VTABS Training switching subsystem.

3.1.2.2.2.2 VTABS Training Subsystem Master Instructor Position - The VTABS Training Subsystem shall provide one Master Instructor position. The Master Instructor Position shall be configured with a dedicated PEM and entry devices; a dedicated workstation for configuration, status monitor, and control of the Training subsystem switching equipment and positions; and a printer interface. The Master Instructor shall be capable of performing A/G and G/G communications functions through the VTABS Training subsystem.

The VTABS shall provide the capability for Master Instructor positions to monitor and control the configuration classmarks of each position, perform data entry functions to define configuration maps, and monitor the status of all equipment in the Training subsystem configuration via a dedicated workstation, user log-on, password, and classmarks.

3.1.2.2.2.3 VTABS Training Subsystem Maintenance Position - The VTABS Training subsystem shall provide status, monitor, and control capability to the maintenance position via a dedicated workstation and local printer interface.

3.1.2.2.2.4 VTABS Training Subsystem Data Entry Operator Position - The VTABS Training subsystem shall provide a dedicated Data Entry Operator position workstation and a local printer interface to support system configuration map build and other system configuration functions.

3.1.2.2.2.5 VTABS Training Subsystem Instructor Positions - The VTABS Training subsystem shall be capable of being configured with up to 16 Analog Telephones that can be used for G/G IC communications between instructors and student/pilot positions. The Analog Telephones shall be capable of placing and receiving IC calls to and from student and pilot positions configured with position electronics modules.

3.2 SYSTEM CHARACTERISTICS

3.2.1 Capacity, Modularity, and Growth

3.2.1.1 VTABS Backup Subsystem Capacity - The VTABS Backup subsystem shall be designed to meet the maximum sizing requirements listed in Table I while supporting the voice traffic loads of Table III.

Table I. Backup Subsystem Sizing Requirements

Sizing Parameter	Maximum
Positions	50
Trunks/PABX (inclusive)	126
Radio or BUEC (inclusive)	190
Analog Telephones	16
Workstations	24

3.2.1.2 VTABS Training Subsystem Capacity - The VTABS Training subsystem shall be designed to meet the maximum requirements listed in Table II while supporting the voice traffic loads of Table III.

Table II. Training Subsystem Sizing Requirements

Sizing Parameter	Maximum
Positions	49
Trunks/PABX (inclusive)	156
Radio or BUEC (inclusive)	254
Analog Telephones	16
Supervisor Recorders	24
Workstations	24

3.2.1.3 VTABS Training and Backup Subsystem Modularity and Growth - The VTABS system design and construction shall meet the sizing requirements for both the Training and Backup subsystems imposed by each operational site up to the system maximum capacity. Both the VTABS Backup and Training subsystems shall be capable of growth in increments as small as one position, trunk, frequency, or workstation at a time up to the system's maximum capacity.

The VTABS shall be capable of modifying the configuration of any position, radio, or trunk interface via the VTABS DEO function (for the Training or Backup subsystem) without disturbing calls in progress or losing incoming communications. Following modification of the configuration database, the VTABS shall provide the capability to download the updated configuration maps, and implement the changes for the affected equipment. Implementation of configuration changes shall not be allowed when the affected equipment is in an operational mode if the changes will impact operations.

In addition, the VTABS shall provide the capability to change any G/G trunk (port) or A/G radio (port) defined in the switching subsystem configuration, to any other trunk or radio type supported by the VTABS. The interconnect subsystem design shall not limit this type of modification.

3.2.1.3.1 VTABS ATC Position Functional Enhancements - The VTABS shall be capable of being enhanced/upgraded to support any changes in A/G, G/G, or ATC position functionality such that it will be functionally and operationally equivalent to the VSCS ATC position and switching functions.

Table III. Grades of Service and Average Traffic Loads Per Position During Peak Busy Hour (PBH) and Peak Busy Minute (PBM)

Function	Grade of Service	Holding Time, S**	Erlangs (PBH)	Calls/Hour During PBH***	Erlangs (PBM)	Calls/Minute During PBM***
PTT (A/G)	Non-Blocking	4	0.13	117	0.234	3.5
Radio Squelch Break	Non-Blocking	4	0.13	117	0.234	3.5
Main/Standby	0.001			4		0.2
TX/RX IC	0.001	20	0.06	11	0.36	1.1
IP Local Initiation	0.001	20	0.06	11	0.36	1.1
IP Remote Initiation	0.001	20	0.06	11	0.36	1.1
PABX Access Local Initiation	0.001	180	0.03	< 1	0.06	0.02
PABX Access Remote Initiation	0.001	180	0.03	< 1	0.06	0.02

** Distribution for holding times is exponential.
*** Distribution for arrival rates is Poisson.

Table IIIa. PBH and PBM Call Distribution

Function	Call Mode	Percentage of Usage
PTT (A/G)	Controller Generated PTT	100 %
IC	non-OVR	15 %
	OVR	85 %
IP	non-OVR	100 %

3.2.2 Performance

The VTABS Backup subsystem shall meet the following performance requirements specified below for all system sizings shown in Table I.

3.2.2.1 Throughput Timing Requirements - The VTABS shall meet the throughput timing requirements specified in Table IV and the paragraphs below, subject to the traffic loads, blocking probabilities, and call distribution during the PBH and PBM conditions shown in Table III and Table IIIa. All specified response times shall be applicable as "end to end" measurement points with reference to the VTABS external equipment interfaces. Response times shall not include touch entry detection time for transactions originating at a position. They shall not include display device response times for transactions terminating at a position. They shall not include the delays and wait periods associated with operator inputs (e.g. digit dialing). For transactions originating at a trunk or radio interface, the beginning of the throughput timing interval shall be receipt by the switch of the complete information needed to service the transaction. For transactions terminating at a radio or trunk interface, the end of the throughput timing interval shall be initiation of the latest event at that interface that does not depend on the interface behavior or protocol; that is, the latest event having timing totally dependent on VTABS performance.

3.2.2.2 A/G Communications Throughput Timing Requirements

3.2.2.2.1 A/G PTT Transmit Response Time - The response time for this event shall be from the instant that an A/G PTT signal is generated (after the PTT switch makes contact without waiting for debouncing) at the position, to the instant that this signal, or the A/G Voice Channels(s) invoked by this signal, whichever is later, is present at the A/G interface with the VTABS. For 95% of the event completions, this event response time shall not exceed 25 msec. For 99.99% of the event completions, this event response time shall not exceed 70 msec. Delays outside the VTABS are not included.

3.2.2.2.2 A/G PTT Indicator Response Time - The response time for this event shall be from the instant that a PTT confirmation signal is present at the radio interface with the VTABS, to the instant that indicator response is activated at the calling position. For 95% of the event completions, this event response time shall not exceed 75 msec. For 99.9% of the event completions, this event response time shall not exceed 200 msec.

If the radio interface does not supply a PTT confirmation, the response time from this event shall be from the instant the PTT confirmation signal is generated by the VTABS radio interface equipment to the instant that the indicator response is activated at the calling position. For 95% of the event completions, this event response time shall not exceed 75 msec. For 99.9% of the event completions, this event response time shall not exceed 200 msec.

Table IV. Setup/Tear down Throughput Timing Requirements During PBH and PBM

Type of Event	Maximum Response Time, msec.* Percent of Event Completion		
	95 %	99.9 %	99.99 %
A/G PTT Transmit	25		70
A/G PTT Indicator	75	200	
System-Generated A/G PTT Transmit	75		150
M/S TX/RX Transfer	75	150	
IC Call Placement	250	350	
IC Call Acceptance	200	300	
Voice Delay	60	70	
Position-to-Trunk IP Call Placement	200	300	
Position-to-Trunk IP Call Placement (type 5)	250	450	
Trunk-to-Position IP Call Placement	200	300	
Trunk-to-Position IP Call Placement (type 5)	250	450	
Position-to-Trunk IP Call Acceptance	250	350	
Position-to-Trunk IP Call Acceptance (type 5)	250	450	
Trunk-to-Position IP Call Acceptance	200	300	

3.2.2.2.3 System-Generated A/G PTT Transmit Response Time
The response time for this event shall be from the instant that a request for a feature which requires a system-generated A/G PTT is present in the VTABS, to the instant that an A/G PTT signal is present at the A/G interface with the VTABS. For 95% of the event completions, this event response time shall not exceed 75 msec. For 99.99% of the event completions, this event response time shall not exceed 150 msec.

3.2.2.2.4 M/S TX/RX Transfer Response Time - The response time for this event shall be from the instant that the M/S TX/RX transfer signal is generated at a position, to the instant that this transfer signal is present at the A/G interface with the VTABS. For 95% of the event completions, this event response time shall not exceed 75 msec. For 99.9 of the event completions, this event response time shall not exceed 150 msec.

3.2.2.2.5 Radio Squelch Break Response Time - The response time for this event shall be from the instant that the squelch break signal is received at the radio interface of the VTABS to the instant the audio path is set up from the radio interface of the VTABS to the position(s). If the radio interface does not provide a squelch break signal, or when the frequency is selected to BUEC, the VTABS shall interpret the reception of voice signals from the radio interface of BUEC interface as a squelch break and shall set up the audio path between the radio or BUEC interface and the position(s). For 99.99% of the event completions this event response time shall not exceed 30 msec.

3.2.2.2.6 Radio Squelch Break Indication Response Time - The response time for this event shall be from the instant the squelch break signal is received or generated at the VTABS radio or BUEC interface to the instant the squelch break indication is presented at the position(s). For 99.9% of the event completions this event response time shall not exceed 200 msec.

3.2.2.3 Ground-to-Ground Throughput Timing Requirements

3.2.2.3.1 IC Call Placement Response Time - The response time for this event, whether it be a two-party IC call or an IC addition to a progressive or preset conference call, shall be from the instant that the address is generated at the position, to the instant that the called position is notified by appropriate VTABS internal signaling. For 95% of the event completions, this event response time shall not exceed 250 msec. For 99.9% of the event completions, this event response time shall not exceed 350 msec.

3.2.2.3.2 IC Call Acceptance Response Time - The response time for this event, whether it be a two-party IC call or an IC addition to a progressive or preset conference call, shall be from the instant that the called position accepts the IC call, to the instant that an indicator response (ringback tone stops) is activated at the calling position, and voice communications over the established path can begin. For 95% of the event completions, this event response time shall not exceed 200 msec. For 99.9% of the event completions, this event response time shall not exceed 300 msec.

3.2.2.3.3 Position-to-Trunk IP Call Placement Response Time - The response time for this event exclusive of type 5 trunks, whether it be an individual position-to-trunk IP call or an IP addition to a progressive or preset conference call, shall be from the instant that the address is generated at the position, to the instant that any signaling is initiated at the trunk interface. For 95% of the event completions, this event response time shall not exceed 200 msec. For 99.9% of the event completions, this event response time shall not exceed 300 msec. For 95% of the event completions, this event response time for type 5 trunks shall not exceed 250 msec. For 99.9% of the event completions, this event response time for type 5 trunks shall not exceed 450 msec.

3.2.2.3.4 Trunk-to-Position IP Call Placement Response Time - The response time for this event exclusive of type 5 trunks shall be from the instant that the complete called address is confirmed at the trunk interface to the VTABS, to the instant that the called position is notified (by a call indicator response). For 95% of the event completions, this event response time shall not exceed 200 msec. For 99.9% of the event completions, this event response time shall not exceed 300 msec. For 95% of the event completions, this event response time for type 5 trunks shall not exceed 250 msec. For 99.9% of the event completions, this event response time for type 5 trunks shall not exceed 450 msec.

3.2.2.3.5 Position-to-Trunk IP Call Acceptance Response Time - The response time for this event exclusive of type 5 trunks shall be from the instant that the called position accepts the incoming IP call, to the instant that the IP call acceptance message signaling is initiated at the trunk interface. For 95% of the event completions, this event response time shall not exceed 250 msec. For 99.9% of the event completions, this event response time shall not exceed 350 msec. For 95% of the event completions, this event response time for type 5 trunks shall not exceed 250 msec. For 99.9% of the event completions, this event response time for type 5 trunks shall not exceed 450 msec.

3.2.2.3.6 Trunk-to-Position IP Call Acceptance Response Time - The response time for this event, whether it be an individual position-to-trunk IP call or an addition to a progressive or preset conference call, shall be from the instant that the IP acceptance message is confirmed at the trunk interface to the VTABS, to the instant the calling position is notified (by a call indicator response), and voice communication over the established path can begin. For 95% of the event completions, this event response time shall not exceed 200 msec. For 99.9% of the event completions, this event response time shall not exceed 300 msec.

3.2.2.4 Voice Delay - For any operational condition such that a position receives the same voice signal through more than one path within the system, or through both the air and the system, then the delay for the signal received through the system shall be less than 5 msec for 99.9% of all event completions during the PBM and PBH conditions specified in Table III and Table IIIa.

3.2.2.4.1 Intrafacility Voice Delay Measurement - The one-way voice measurement shall be from the instant the voice signal enters the transmitting port (position, trunk, or radio port) to the instant the voice signal is received at the output of the receiving port (position, trunk, or radio port). When PTT is required for voice transmission, the voice delay test signal shall be sent for measurement after the A/G or G/G PTT transmit response time (as specified in Table III) has elapsed.

3.2.2.4.1.1 Position-to-Position Voice Delay Measurement - The position-to-position one-way voice delay measurement shall be from the instant that the voice signal is present at the transmitting position's microphone to the instant that the voice signal is received at the receiving position's headset or loudspeaker.

3.2.2.4.1.2 Position-to-Trunk Voice Delay Measurement - The position-to-trunk one-way voice delay measurement shall be from the instant the voice signal is present at the position's microphone to the instant that the voice signal is received at the trunk output interface. For trunk-to-position, the one-way voice delay measurement shall be from the instant that the voice signal is present at the trunk input interface to the instant that the voice signal is received at the position headset or the position loudspeaker.

3.2.2.4.1.3 Position-to-A/G Interface Voice Delay Measurement - The position-to-A/G interface one-way voice delay measurement shall be from the instant voice signal is present at the position's microphone to the instant that the voice signal is received at the VTABS A/G interface. This measurement shall begin after the A/G PTT transmit response time specified in Table III has elapsed. The A/G interface-to-position one-way voice delay measurement shall be from the instant the voice signal is present at the A/G interface to the instant that the voice signal is received at the position headset or loudspeaker.

3.2.2.5 Voice Channel Performance Characteristics - The VTABS voice channel performance shall meet the requirements of the following paragraphs.

3.2.2.5.1 Impedance - Each voice frequency (VF) circuit within the system shall present a nominal impedance to its interface in accordance with the requirements set forth in the IRDs.

3.2.2.5.2 Background Noise - Combined hum and noise level of any single receive voice path within a VTABS, measured at the position jacks, with the headset volume control set to nominal, with both ends of the path properly terminated, shall not exceed 20 dBrnC for the C-message weighted noise and 35 dBrn for the 3 KHz flat noise. Combined hum and noise level of any single transmit voice path within a VTABS, measured at the interface with external equipment, with both ends of the path properly terminated, shall not exceed 20 dBrnC0 for the C-message noise and 35 dBrn for the 3 KHz flat noise. This test shall be performed with the Automatic Gain Control (AGC) enabled.

3.2.2.5.3 Idle Channel Noise - With the input terminated in the nominal impedance, noise measured at the output shall not exceed 23 dBrnC0. This test shall be performed with the AGC enabled.

3.2.2.5.4 Crosstalk Between Channels - The crosstalk coupling loss between any transmit or receive path of an independent VF circuit or between any digital signal transmit and receive path through VTABS electronics shall be greater than or equal to 72 dB. This test shall be performed with the AGC disabled.

3.2.2.5.5 Frequency Response - The frequency response for all frequencies between 300 Hz and 3000 Hz shall be within the limits (where + equals more loss and - equals less loss) of the 1000 Hz amplitude level measured at the voice channel output for the voice channels defined in Table Va. Trunk types are described in the VSCS-Trunks IRD. The test input signal shall be at the standard telephone test tone level of 0 dBm0. To protect other services from interference due to frequencies that are above the voice band, the signal applied to VTABS interfaces shall not exceed the limits specified in Table V. This test shall be performed with the AGC disabled.

Table V. Frequency Response Characteristics

Frequency, KHz	Maximum Power Below Zero TLP, dB
3.955 to 4.005	-21
4.0 to 10.0	-16
10.0 to 25.0	-24
25.0 to 40.0	-36
Above 40.0	-50

Table Va. Voice Channel Test Limits

Voice Channel	Test Limits
Radio Interfaces	-1.5 to +0.6
Type 4 Trunk	-0.5 to +0.6
Type 4/5 Trunk	
Type 5 Trunk	
Type 7 SF Signaling Trunk	
Type 9 Trunk	
Type 20 Trunk	
Type 3 (all except Loop Signaling) Trunk	-1.6 to +2.6
Type 3 Loop Signaling Trunk	-1.75 to +4.85
Type 8 Loop Signaling Trunk	
Type 6/CO PBX	-1.5 to +2.4
Type 7 DX Signaling Trunk	-1.0 to +1.7
Type 7 4-W E&M Signaling Trunk	-1.5 to +1.7
PABX 4-W E&M Signaling Trunk, Same Facility	
PABX 4-W E&M Signaling Trunk, Different Facility	

3.2.2.5.6 Measurement Method - The above transmission performance characteristics shall be measured using the standard test method specified in Section 4.8.2 of EIA/TIA-464A, IEEE-STD-743-1984, or equivalent.

3.2.2.5.7 VTABS Speech Intelligibility - The VTABS shall pass a phonetically balanced monosyllabic word test conducted in accordance with ANSI S3.3-1989 with a minimum score of 90% for each of the following call types with voice routed to the headset:

a. IC call between two positions.
b. IC call between a position and an Analog Telephone unit.
c. IP call between two position over two trunks looped back.

3.2.2.5.8 VF Level Regulation - The level of VFs between 300 Hz and 3000 Hz when transmitted and received at positions shall be regulated by the VTABS as follows.

3.2.2.5.8.1 Transmit Level Regulation - Automatic voice level regulation shall be provided in all transmitting voice paths from any position to maintain a level within ± 1.5 dB of the nominal output level measured at the analog output from the position equipment. The nominal output level shall be -9.0 dBm0. The level regulation operating range shall be between +12 dB and -9 dB of the nominal input test tone level. The nominal input test tone shall be 1004 Hz at a level of -9.0 dBm injected at the jack module. Threshold detection circuits shall be included in the position such that when the input signal is below the regulation range, the output shall be attenuated by 9 dB. Regulation shall accommodate a 12 dB sudden increase, and subsequent decrease, in accordance with the following paragraphs. The transmit level regulation transfer function is illustrated in Figure 3-1A. This test shall be performed with the AGC enabled.

3.2.2.5.8.1.1 12 dB Sudden Increase - The instantaneous output level, including transients, shall not increase by more than 12 dB or decrease by more than 3 dB. The output level shall be within ± 0.5 dB of the final steady-state value within 10 msec from the instant of input level change. This test shall be performed with the AGC enabled.

3.2.2.5.8.1.2 12 dB Sudden Decrease - Immediately following the 10 msec stabilization period after the 12 dB increase, and with a sudden 12 dB decrease, the output shall stabilize to within 2 dB of the final steady-state value in not less than 400 and no more than 600 msec from the instant of input level change. This test shall be performed with the AGC enabled.

3.2.2.5.8.2 Receive Level Regulation - Automatic voice level regulation shall be provided, at the interface, in the receiving voice paths from all IP, A/G or PABX circuits. With up to an 8 dB change in the received level of a 1004 Hz test tone at a level of -9.0 dBm0, the received level measured at the position headset jack shall remain within ± 1.5 dB of the nominal value of -25 dBm with the headset volume control set to nominal Threshold detection circuits shall be included such that when the input signal is below the regulation range, the output shall be attenuated by 8 dB. The receive level regulation transfer function is illustrated in Figure 3-1B. This test shall be performed with the AGC enabled.

3.2.2.5.8.3 Multiple Access Level Regulation - Multiple access at a position in an OVR mode, multiple access to IP and multiple distribution of a single trunk to up to the maximum number of positions at a facility shall be such that the cumulative loss due to multiple access in all cases shall not exceed 3 dB. The requirement also applies to conference connections. This test shall be performed with the AGC enabled.

3.2.2.5.9 Measurement Method - The above transmission performance characteristics shall be measured using the standard test method specified in Section 4.8.2 of EIA/TIA-464A, IEEE-STD-743-1984, or equivalent.

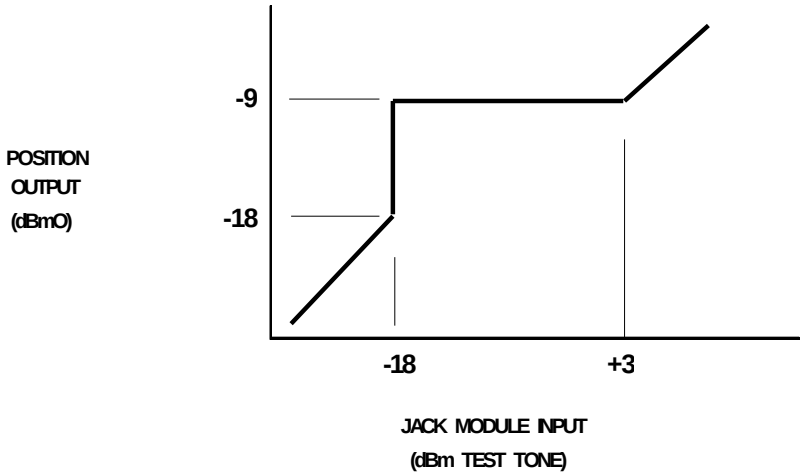

Figure 3-1A. Transmit Transfer Function

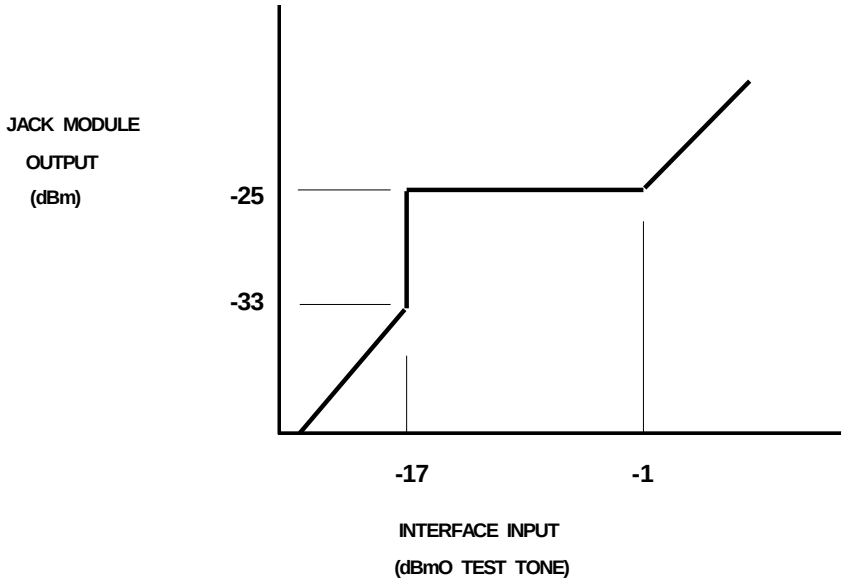

Figure 3-1B. Receive Transfer Function

3.2.2.6 Sidetone - The VTABS shall provide audio sidetone to all (up to four) jacks at a position for all communications emanating from the position. This sidetone shall be generated at the position and shall be such that with the independent sidetone control set to 0 dB and with a test tone of 1004 Hz at a level of -9 dBm injected into the transmit path of the position jack, the level measured at the receive path of the position jack shall be -25 dBm ± 1.5 dB. This sidetone shall be adjustable by the position operator via an independent sidetone volume control. A minimum of 5 levels of adjustment from 0 dB to a minimum level of at least -12 dB shall be provided in increments no greater than 3 dB. The volume control for sidetone shall be independent from all other volume controls. The sidetone shall be provided through the headset or handset and shall not be audible through the position loudspeaker at any time. AGC shall be enabled on sidetone.

3.2.2.7 Headset Volume Control Nominal Setting - The nominal setting of the headset volume controls is defined as follows: With an IC connection between two positions and with a test tone of 1004 Hz at a level of -9 dBm injected into the position jack of the transmitting position, the headset volume control shall be adjusted to provide a level of -25 dBm measured at the receiving position jack. The maximum and minimum value control setting shall be within ± 2.0 dB of -20 dBm and -52 dBm with a -9 dBm audio input level.

3.2.2.8 Headset Limiting Transient Response - Headset output limiting shall be such that from the onset of a sudden receive input level increase from -19 dBm0 to +6 dBm0, the instantaneous headset output level shall be within ± 2.0 dB of -20 dBm (RMS) within 100 msec ± 20 msec. Headset output limiting shall be such that from the onset of a sudden receive input level decrease from +6 dBm0 to -19 dBm0, the instantaneous headset output level shall be within ± 2.0 dB of -20 dBm (RMS) within 500 msec ± 100 msec. These tests shall be performed with the headset volume set to maximum and AGC disabled.

3.2.3 Reliability, Maintainability, Availability (RMA)

The achievement of inherent availability, as stated below, shall drive the reliability and maintainability specifications for this system; therefore the primary RMA driver for the VTABS shall be availability. Elements of the specified availability for the VTABS shall be a system design goal and shall be demonstrated using reliability and maintainability parameters for the system obtained from analysis, test, and the database of existing systems. Elements of the reliability and maintainability programs that are fixed are specified in 3.7. The specified availability for this system shall be the inherent availability $A_{(I)}$, for each VTABS function:

$$A_{(I)} = MTBCF_{(f)} / [MTBCF_{(f)} + MTTR_{(f)}]$$

where:

$A_{(I)}$ = inherent availability
$MTBCF_{(f)}$ = mean time between critical failures for each VTABS functional path (see Appendix I)
$MTTR_{(f)}$ = mean time to repair for each VTABS functional path

VTABS availability shall include the device used to switch console devices between VSCS and VTABS, but shall exclude the Transition Switch.

VTABS availability shall be calculated separately for the Training and Backup subsystems, but the same availability requirements defined herein shall be met by each (Training and Backup) subsystem.

3.2.3.1 Position-Level Availability - Availability requirements at the position level are defined as all functions required in the specification. A functional failure has occurred when an operational position cannot provide and maintain the required connectivity and control signals to its assigned functions. Position-level functions shall exhibit the corresponding availability specified in Table VI. Non-VTABS hardware/software is not included in VTABS availability determination.

Table VI. Position-Level (Functional) Availability Requirements

Function	$A_{(I)}$
Radio A/G	0.9995
Intercom	0.9995
Interphone	0.9995

3.2.3.2 System-Level Availability - The availability of the VTABS is determined by the number of positions whose critical functions are operationally available. A system failure occurs when one or more critical functions are unavailable in more than 10% of the positions. All systems shall exhibit a hardware availability of no less than 0.9997 which will be verified through analysis. As a design goal the VTABS system availability for hardware and software combined, shall be 0.9997, which is to be achieved by the completion of key site testing.

3.3 VTABS FUNCTIONAL REQUIREMENTS

3.3.1 VTABS ATC Position and Communications Functional Requirements

The VTABS Training and Backup subsystems shall provide Equivalent ATC position operations for control of position functions, initiation and reception of A/G and G/G communications. The ATC functions provided by the VTABS shall be operationally and functionally equivalent to the ATC functions provided by the VSCS. The VTABS display and keypad operations shall be identical to these in the VSCS to minimize operational impacts to ATC position operators following transition. The VSCS Human Factors Design Document Volume I shall be used as a guide for all ATC functions and computer interface implementation.

The Backup subsystem ATC position equipment shall be capable of providing all A/G and G/G communications and position functions through the VSCS entry and display devices immediately following switchover from the VSCS equipment.

The Training subsystem ATC position equipment shall be capable of providing all A/G and G/G communications, and position functions through the VSCS entry devices and display devices installed in the DYSIM consoles.

In both the Training and Backup subsystems, all ATC position functionality shall be controlled by position map classmarks defined and downloaded to the position from the respective control subsystem.

The VTABS shall provide additional features required for ATC controller/pilot training scenarios. The requirements for these features are specified in paragraph 3.4 of this specification. The VTABS training features shall be controlled by system and functional classmarks defined in the control subsystem, and downloaded to the training positions, switching subsystem, and workstations as required.

3.3.1.1 VTABS A/G Communications Functional Requirements

3.3.1.1.1 General A/G Communications Requirements - Each air traffic controller operating position within the VTABS Training and Backup subsystem shall be provided the capability for assignment of A/G communications functions. Assignment of an A/G communications function at a given air traffic controller position shall be controlled by configuration maps. The VTABS position and switching subsystem shall provide the A/G communications functions through each of the existing radio interface types supported by the VSCS. A/G communications functions shall include the following:

a. Selection and deselection of the position's assigned frequencies.

b. M/S transmitter selection for each assigned frequency, as applicable.

c. M/S receiver selection for each assigned frequency, as applicable.

d. Independent enabling/disabling of transmission for each selected frequency at an operational position.

e. Independent local muting of received voice for each selected frequency at an operational position, for frequencies assigned to split-mode operations by site adaptation data.

f. Remote muting of receivers for selected frequencies.

g. Transmitter/receiver remote site selection for designated frequencies that have radio outlets at more than one remote site.

h. Enabling and disabling of automatic transfer of A/G voice from HS to LS if the operator engages in G/G voice communications.

i. Selection and assignment of BUEC.

j. Selection of UHF or VHF emergency frequencies, or both, for reception or transmission, or both.

k. PTT preemption capabilities for selected frequencies.

l. Manual selection of routing of incoming voice to HS or LS for each selected frequency at a position, for frequencies assigned to split-mode operations by site adaptation data.

m. PTT lockout when A/G transmission is attempted on a frequency that is in use by another position.

n. Visual indication on all selected/enabled frequencies of the presence of squelch break on received voice or PTT confirmation on transmitted voice.

o. Confirmation of PTT, M/S selection, remote and local muting, and frequency selection.

p. Enabling and disabling of radio transfer of A/G voice from HS to LS.

Requirements for each of the above listed A/G communications functions are detailed in the following paragraphs.

3.3.1.1.1.1 A/G Frequencies Assignment - Operational positions shall access A/G capabilities through radio or BUEC interfaces. The frequency assignments shall be defined in the position configuration map(s). The capability shall be provided to assign access for up to 24 unique frequencies to all operational positions.

3.3.1.1.1.2 Fan-In Feature - The switching and control functions shall be capable of receiving A/G voice from any radio or BUEC interface and providing it and associated signaling to up to 24 positions that have been assigned access to that interface. There shall be no degradation in signaling time or in voice quality at any of the positions as a result of the number of positions assigned.

3.3.1.1.1.2.1 Emergency Frequency Fan-In - All A/G positions shall be capable of receiving A/G voice from radio interfaces for the emergency frequencies of 121.500 MHz and 243.0 MHz. Fan-in of voice and signaling shall be provided only to those positions assigned access to each radio interface.

3.3.1.1.1.3 Fan-Out Feature - The switching and control functions shall be capable of managing access to the radio interface or the BUEC interface from up to 24 assigned positions to any given interface so that only one position is capable of transmission on the interface at any one time. All positions with that frequency assignment shall receive transmission status signals.

3.3.1.1.2 Frequency Selection - Each air traffic controller position that has been assigned A/G communications capabilities shall have the capability to select any frequency or frequencies from those assigned to the position. Frequency assignments for a given operational position shall be resident in the configuration database position map(s). Selection of a frequency that is not in a multiple site group at an operational position shall cause the enabling of either the main or standby transmitter, and either the main or standby receiver, whichever is on line. Selection of a frequency that is in a multiple site group shall function as specified in 3.3.1.1.2.9, Multiple Sites For A Frequency.

3.3.1.1.2.1 Assigned Frequency Display - Every frequency that is assigned to a given air traffic controller operational position shall be continuously visible to the operator on the position display. Distinct illuminated conditions shall be provided to enable the operator to distinguish between selected and unselected frequencies available to the position.

3.3.1.1.2.2 Displayed Frequency Values - All frequency values shall be displayed with values in MHz and decimal fractions thereof, to three decimal places (e.g., 125.550, 217.300). All frequency indications shall have a decimal point separating the integer and fractional portions of the frequency value.

3.3.1.1.2.3 Frequency Selection Method - An assigned radio frequency shall be selected by a single touch action by the position operator. A selected frequency shall be deselected by individual touch actions that disable the transmission and reception associated with the frequency.

3.3.1.1.2.4 Routing of Incoming Voice - The VTABS shall provide for position operator selection of routing of received voice radio communications on each selected frequency to either the position headset/handset or to the position A/G loudspeaker. A visual indication of the voice routing selected for each selected frequency shall be provided. Incoming voice radio communications shall be routed as selected commensurate with the requirements for automatic transfer of A/G voice routing and the radio transfer function.

3.3.1.1.2.5 TX/RX Visual Indications - The VTABS shall provide distinct visual indications of the presence of PTT confirmation and receiver squelch break on every assigned frequency at an operational position whether or not the frequency has been selected for use at the position. If the radio interfaces do not provide either or both the PTT confirmation signal and squelch break, the signals shall be generated internally by the VTABS on every selected frequency at an operational position. Visual indication of PTT confirmation on frequencies selected for transmission shall be made after receipt of PTT confirmation. Visual indications shall clearly allow the position operator to distinguish between PTT on those selected frequencies at the position with transmit capabilities enabled and those with transmit capabilities not enabled, and between reception of squelch break on selected frequencies at the position with receive capabilities enabled and those with receive capabilities not enabled.

3.3.1.1.2.6 Frequency Status Display - For each air traffic controller position that has been assigned A/G communications capabilities, the VTABS shall provide access to a frequency status display which provides simultaneous visual indication of real time frequency status for all frequencies selected at that position, up to 24 frequencies. Individual frequency displays shall indicate the frequency value, site designator if multiple sites for a frequency are used, and the selected routing (HS or LS) for the frequency. Frequency status information shall include PTT confirmation, squelch break, PTT lockout and for those radio interfaces that provide a PTT Trunk Lockout signal, a radio interface PTT Trunk Lockout indication. For frequencies with multiple sites, a visual indication of the selected state of the voting algorithm shall be provided for each site group, and a visual indication of the selected state of the frequency site group maintenance function shall be provided for each frequency site. The frequency status display shall have the capability to allow the position operator to select the transmitter site on a call-by-call basis for multiple site frequencies. All other A/G selections and functions shall be activated via the appropriate touch action(s) to the A/G display. The position operator shall have the ability to enable and disable the frequency status display.

3.3.1.1.2.7 M/S Transmitter Selection - Every air traffic controller position that has been assigned to have A/G communications capabilities shall have the capability to select either the main or the standby transmitter for each selected frequency at the position.

3.3.1.1.2.7.1 M/S Transmitter Visual Indication - The A/G display at an operational position shall have a continuously visible indication of main or standby transmitter selection status for every enabled transmitter at the operating position. BUEC frequencies shall not have M/S transmitter indications.

3.3.1.1.2.7.2 M/S Transmitter Selection Method - The assignment of main or standby transmitter for a selected frequency shall require no more than two touch actions. If one touch is used, the position operator shall apply a single touch to toggle the transmitter to change the assignment to main or standby. If two touches are used, the position operator shall apply one touch to a main/standby function touch area, and a second touch to the transmitter touch area of a selected frequency to enable selection of transmitter main or standby. M/S transmitter selection shall function only for frequencies that have been selected by the position operator and are not using BUEC.

3.3.1.1.2.7.3 M/S Receiver Selection - Every air traffic controller position that has been assigned A/G communications capabilities shall have the capability to enable either the main or the standby receiver for each selected frequency at the position.

3.3.1.1.2.7.4 M/S Receiver Visual Indication - The A/G display at an operational position shall have a continuously visible indication of the main or standby receiver selected status for every frequency selected at an air traffic controller operating position. BUEC frequencies shall not have M/S receiver indications.

3.3.1.1.2.7.5 M/S Receiver Selection Method - The assignment of main or standby receiver for a selected frequency shall require no more than two touch actions. If one touch is used, the position operator shall apply a single touch to toggle the receiver to change the assignment to main or standby. If two touches are used, the position operator shall apply one touch to a main/standby function touch area and a second touch to the receiver touch area of a selected frequency to enable selection of receiver main or standby. M/S receiver selection shall function only for frequencies that have been selected for use by the position operator and which have not been selected for BUEC.

3.3.1.1.2.7.6 Selection Using Transceivers - The above requirements shall not preclude the use of tunable radio transceivers. For facilities with access to tunable transceivers, M/S transceiver selection shall be provided. Tuning shall be accomplished external to the VTABS. Frequency selection shall be as described in 3.3.1.1.2.

3.3.1.1.2.8 Position Control of Transmission and Reception - The VTABS shall provide the capability for the enabling or disabling of the transmission of voice from a position for any selected frequency. The VTABS shall provide the capability for the enabling or disabling of the reception of voice at a position for any selected frequency. Local disabling of either the transmission or reception at an operational position, but not both, for a selected frequency shall not cause deselection of the frequency at the position. Disabling of both transmission and local reception for a selected frequency at a controller position shall cause the deselection of the frequency at the position. Disabling of transmission or reception for any frequency at any position shall not affect transmission or reception on that frequency at any other position.

3.3.1.1.2.8.1 Muting of Receivers

3.3.1.1.2.8.1.1 Muting Indication - The muting status of the receiver for each frequency selected at an operational position shall be continuously visible to the position operator. Remote mute status shall be continuously displayed at each position with the frequency selected regardless of the local mute state of that frequency at the position. Selection or deselection of remote muting shall not alter a position's local mute state for that frequency.

3.3.1.1.2.8.1.2 Local Muting Selection Method - Local muting of the receiver for a selected frequency at a controller position shall be accomplished by a single touch action by the position operator.

3.3.1.1.2.8.1.3 Remote Muting - For radio interfaces that provide remote muting capability, the VTABS shall provide air traffic controller positions the capability to remotely mute received voice for specified assigned frequencies at the air traffic controller position. Selection of remote muting for a frequency shall not effect a frequency deselection for that frequency at any position that has the frequency selected. Remote receiver muting is not used with some existing radio interfaces.

3.3.1.1.2.8.2 Tracking of Radios in Selective (Paired) Mode - For selective (paired) frequencies, a radio classmark shall be defined in the configuration data base that, when enabled, any operational position which has the pair assigned on its AG screen shall enable both transmitters of the pair when either of the transmitters is enabled. Disabling of transmitters is not affected by transmitter mode selective tracking. The enabling of a receiver in the pair shall enable both receivers of the pair. Likewise, the disabling of the receiver of one member of the pair shall disable both receivers of the pair.

3.3.1.1.2.9 Multiple Sites for a Frequency - The VTABS shall provide the capability, for a given assigned frequency at an appropriately classmarked operational position, to access multiple remote transmitter/receiver/ transceiver sites for that frequency through multiple radio interfaces. For operational positions assigned multiple sites for a frequency, the assigned frequency display shall provide a continuously visible indication of the site for each frequency. The capability shall be provided for one or more operational positions to be classmarked for transmitter site selection for a frequency. At any position with a transmitter enabled for the frequency, or at a position attempting to enable any transmitter for the frequency, the transmitter site selected by any classmarked position shall be displayed as enabled. The VTABS shall provide controls such that only one of the transmitters for the frequency is enabled at a time for all positions having that frequency. A single touch action to a transmitter of a selected frequency/site at a classmarked position shall disable the previously enabled transmitter and enable the selected transmitter. For deselected frequency/sites in a multiple site group, selection of a deselected noncurrent site shall cause the enabling of the main or standby receiver only. A second selection to the disabled transmitter button shall be required to enable the current site transmitter, and disable the transmitter of the previously selected site if the position is classmarked for site selection. Selection of a deselected current site shall enable both the transmitter and receiver with a single touch. For operational positions using this feature, and accessing transmitter/receiver/ transceiver sites via radio interfaces that provide signal strength information, the VTABS shall provide a voting algorithm to preclude mutual interference on received voice from the enabled receivers on the frequency.

When multi-site same frequency receivers do not provide signal strength information, the VTABS shall use squelch break information provided either externally by radio control equipment, or internally by the VTABS, to select the first audio signal received and pass that signal to the operational position while muting all other same frequency signals. The diversity voting feature shall include the following capabilities:

a. Controllers shall be able to manually toggle the voting algorithm ON and OFF, and to select/deselect the audio present at any receiver within the group when voting is disabled. When the voting algorithm has been manually disabled, signal voting shall not resume until the voting algorithm is manually enabled.

b. A visual indication of the selected state (voting algorithm enabled or disabled) shall be provided by diversity group at all affected operational positions.

c. When two independent signals from two receive sites are received, the voting algorithm, if enabled, shall pass to the console the audio that caused the first detected squelch break. End of reception from the voted receiver shall cause the present audio from the second receiver to be forwarded to the operational position(s) without the need for additional PTT keying from the second transmitter (aircraft).

d. A visual indication of squelch break shall be provided at the operational position(s) for all receivers that pick up the audio signal, regardless of the state of the voting algorithm. The capability shall be provided for up to six (6) diversity receiver sites per frequency at each operational position.

e. When at least one frequency of one multiple site group is paired with a frequency in another multiple site group (i.e., sharing a single trunk); enabling/disabling the diversity voting algorithm for one group shall automatically enable/disable it for the other multiple site group.

3.3.1.1.2.9.1 PTT Receiver Muting of Multiple Sites - When PTT is active at the interface for any site, for a frequency configured for multiple sites, the switching function shall completely mute the received radio voice at the interfaces for all sites for the frequency. This function shall also apply when one or more of the sites have been selected for BUEC.

3.3.1.1.2.9.2 Site Group Maintenance - The VTABS shall provide the capability for a VTABS position with multiple site group frequencies assigned to be configured with the capability to independently enable the transmitter(s) of a frequency site(s) within a multiple site group for maintenance purposes with no impact to the current transmitter site selection, other frequency sites in the site group, or other ATC positions with the site group assigned.

3.3.1.1.2.9.2.1 Site Group Maintenance Assignment - The VTABS shall provide the capability for frequency site group maintenance to be assigned on a frequency classmark basis and then assigned to a position via temporary modification reconfiguration.

3.3.1.1.2.9.2.2 Site Group Maintenance Indications - The VTABS shall provide a visual indication to all positions having a frequency site that is selected for site group maintenance for the duration that the frequency site is in maintenance.

3.3.1.1.2.9.2.3 Site Group Maintenance Selection Method - The VTABS shall provide access to the site group maintenance capability. A position operator shall activate the frequency site group maintenance selection function with a single touch action. A visual indication shall be provided that the site group maintenance selection function is enabled. A subsequent touch action to a displayed frequency site shall designate the frequency site as selected for

site group maintenance. The site group maintenance selection function shall be disabled if no frequency site selection is made within 15 seconds after the site group maintenance function is enabled. Selection of a frequency site for site group maintenance shall remove the frequency from the diversity algorithm (if enabled) for the multiple site group.

3.3.1.1.2.9.2.4 Site Group Maintenance Deselection - The use of site group maintenance for a frequency site shall be deselected by enabling the selection function and a subsequent touch action to a displayed frequency site with frequency site group maintenance selected.

3.3.1.1.2.10 Automatic Transfer of A/G Voice Routing - For operational positions with A/G communications capabilities, the VTABS shall provide for the automatic transfer of the routing of incoming A/G voice from the headset/handset to the position's A/G loudspeaker under the following circumstances: the position operator is engaged in G/G communications, except incoming override calls or outgoing position voice monitor calls; the incoming A/G voice is routed to the position headset/handset; and the receiver is enabled. The position operator shall be provided the capability to enable and disable automatic transfer of routing incoming A/G voice from the position headset(s) to the position A/G loudspeaker. If the automatic transfer of routing incoming A/G voice from the headset/handset to the position's A/G loudspeaker has been disabled, the position operator is engaged in G/G communications using the position headset/handset and has also selected incoming A/G to be routed to the position's headset/handset, and the radio transfer function has been disabled, the incoming A/G voice shall be heard with the G/G voice in the headset/handset. Incoming A/G voice shall be automatically routed to the position A/G loudspeaker at an inactive operational position. The capability to enable and disable automatic transfer of A/G voice from HS to LS, shall be disabled when a position operator enables position split functionality mode.

3.3.1.1.2.10.1 Automatic Transfer of A/G Voice-Routing Indication - For operating positions with A/G communications capabilities, the current selection status for automatic transfer of A/G voice routing shall be continuously visible to the position operator.

3.3.1.1.2.10.2 Automatic Transfer of A/G Voice-Routing Selection Method - Automatic routing transfer of A/G voice shall be enabled or disabled by a single touch action by the position operator.

3.3.1.1.2.11 Radio Transfer (R/T) Function - The R/T function shall provide the capability to route all incoming A/G voice at a position to the position's A/G loudspeaker. When enabled the R/T function shall operate regardless of Automatic Voice Routing or individual A/G frequency HS/LS selections. The R/T function shall also suspend current voice monitors and shall be capable of being enabled/disabled by a controller at any time. The R/T function shall be available to a position operating in split functionality mode but shall only affect the dual jack module dedicated to G/G communication. The effect of the R/T function on a position operation in split functionality mode shall be to automatically suspend the A/G monitor function between the G/G and A/G dual jack modules and to automatically suspend all active voice monitors at a position. The R/T function shall have no effect on incoming A/G communication to a position operating in split functionality mode.

3.3.1.1.2.11.1 Radio Transfer (R/T) Function Indication - The current selection status of the R/T function shall be continuously visible to the position operator.

3.3.1.1.2.11.2 Radio Transfer (R/T) Function Selection Method - The R/T function shall be enabled or disabled by a single touch action by the position operator.

3.3.1.1.2.12 VTABS BUEC Access - The VTABS Backup subsystem shall provide access to the BUEC system from any air traffic controller position that has A/G communications capabilities enabled and frequencies assigned with BUEC classmarked. BUEC selection and frequency assignment shall be accomplished through operator actions using the position interactive display device(s). For any given frequency at an operational position, accessing BUEC shall inhibit using any communication control normally provided by the radio interface for that frequency.

3.3.1.1.2.12.1 BUEC Indications - The VTABS shall provide visual indications of which frequency or frequencies, if any, have been selected for and are using the BUEC system. The position operator shall be provided with a visual display of the BUEC Priority-Level site selected by BUEC and in use for servicing A/G communications on each frequency selected for BUEC. The position initiating the BUEC access request shall be provided a visual and/or audible alert indication in accordance with the VSCS-BUEC IRD, if BUEC access is requested and is for any reason not available.

3.3.1.1.2.12.2 BUEC Selection Method - The VTABS shall provide access to BUEC in accordance with the VSCS-BUEC IRD. A position operator shall activate the BUEC selection function with a single touch action. A visual indication shall be provided that shows that the BUEC selection function is enabled. A subsequent touch action to a displayed frequency value at the position shall designate the frequency as selected for transfer to BUEC, and disable the BUEC selection function and its visual indication. The BUEC selection function shall be disabled if no frequency designation is made within 15 seconds after the BUEC selection function is enabled.

3.3.1.1.2.12.2.1 Request Selection - The switching function shall recognize a request for a BUEC frequency access from an operational position that has the frequency selected and BUEC access permitted, which shall enable both transmission and reception of voice. The switching function shall store the operational configuration of the radio interface selections for each position assigned the frequency and shall disable PTT to the radio interface for the frequency. The VTABS shall then enable voice and signaling to the assigned BUEC access port from all positions with the frequency selected. The switching function shall recognize a BUEC SELECT signal from the position and shall deliver it to the assigned port. The BUEC selection function shall be disabled if no frequency designation is made within 15 seconds after the BUEC selection function is enabled. The M/S transmitter and M/S receiver selection status for the frequency shall revert to the current selection status in effect as determined by the VTABS A/G interface. An alert shall be provided to the maintenance and NAS Manager positions when a priority module or malfunction indication is expected, but is not received within 10 seconds.

3.3.1.1.2.12.2.2 Malfunction Indication - Upon receiving the malfunction indication, MALF, from the BUEC interface, only the position that initiated the BUEC select command for the frequency and the area supervisory position shall receive an alarm to indicate the BUEC access malfunction. The switching function shall automatically assume a BUEC deselection.

3.3.1.1.2.12.2.3 Priority Indication - Upon determination of the BUEC priority module accessed, all positions with that frequency selected shall be provided with the priority module number, and the switching function shall be enabled for recognition of position requests for:

a. PTT keying.
b. BUEC deselection.

3.3.1.1.2.12.3 BUEC Deselection - The use of BUEC for a selected frequency shall be deselected by a two-touch action. A position operator shall activate the BUEC selection function with a single touch action. A visual indication shall be provided that the BUEC selection function is enabled. A subsequent touch action to a displayed frequency value currently assigned to BUEC shall disable BUEC for that frequency, and disable the BUEC selection function and its visual indication. Upon recognizing a BUEC deselection request, a control signal shall be provided to the assigned port for the frequency to effect deselection. PTT signaling shall be disabled from BUEC. The switching function shall then reestablish the most recent operational configuration of transmission and reception with the A/G interface for each assigned position's previously stored selections.

3.3.1.1.2.13 Selection of Emergency Frequencies - The VTABS shall provide every air traffic controller position that has A/G capabilities the capability to access the UHF and VHF emergency frequencies of 243.0 MHz and 121.500 MHz. The VTABS shall provide connectivity to the radio interfaces for the emergency frequency transmitters and receivers from all air traffic controller positions that have the emergency frequencies assigned.

Each position operator shall be allowed to disable, in any order, all but one assigned VHF and all but one assigned UHF emergency frequency transmitter. Each position operator shall be prohibited from disabling the remaining enabled UHF and VHF emergency transmitter assigned to the position. The position operator shall have the capability of local muting or enabling reception of voice at the position, for either or both emergency frequencies. All workstations shall receive an alarm indication when any of the emergency receivers are not being monitored by at least one operational position.

3.3.1.1.2.13.1 Emergency Frequency Indications - Emergency frequencies and emergency frequency control areas shall be uniquely marked on operational position interactive displays.

3.3.1.1.2.13.2 Emergency Transmitter Activation - Transmission on either emergency frequency or both of the emergency frequencies simultaneously shall require a single, continuous, nonlatching touch action by the position operator on the desired emergency frequency select area. Voice from the position shall be transmitted over the selected emergency frequency (frequencies) and over all other frequencies at the position that are selected and have transmitters enabled, for the duration of the operator touch. A visual indication shall be provided to every position operator with emergency frequency assignments to notify of the activation of an emergency frequency transmitter.

3.3.1.1.2.13.3 Emergency Transmitter Lockout - Activation of a transmitter for either emergency frequency at an operational VTABS position shall lock out use of that transmitter at all other VTABS operational positions for the duration of the transmission. The position operator at a locked-out position shall be provided visual and audible indications that the emergency frequency access has been locked out, if PTT is attempted on the emergency frequency.

3.3.1.1.2.14 A/G PTT - All voice transmission of A/G communications, except emergency frequency communications, at an air traffic controller position operating on a VTABS PEM shall be activated by either a hand-activated PTT device or a foot-activated PTT device at the discretion of the position operator.

The VTABS shall provide PTT signaling at the radio interface for the frequency while PTT is engaged. The VTABS shall inhibit simultaneous PTT keying on each frequency interface. The switching function shall provide PTT signaling to the radio interface when PTT on a frequency is recognized, shall provide voice transmission, and shall expect PTT Confirmation from those radio interfaces that provide PTT Confirmation. For existing radio interfaces that do not provide PTT Confirmation, the VTABS shall generate them internally. The VTABS shall recognize a continuous PTT confirmation from the radio interface while receiving the radio interface PTT confirmation signal. The VTABS shall continue to generate the internal PTT confirmation signal for the radio interfaces so long as PTT is being sent to these interfaces. The switching function shall provide the PTT confirmation to the originator of the PTT, shall enable a PTT lockout capability to all other positions that have selected the frequency, and shall provide a squelch break signal, or equivalent, to all positions that have the frequency assigned that shall indicate that voice transmission is occurring. An alert shall be provided to the maintenance position when PTT confirmation is expected but is not received from the radio interface within one second.

When PTT is released, appropriate signaling, control, and status shall be similarly distributed to the radio interface and to all positions with the frequency assigned.

3.3.1.1.2.14.1 PTT for Selected Frequency Operations - When two frequencies are in the selective mode and a PTT signal is activated on one of the two frequencies, both frequencies shall be locked out to PTT at all other positions with those frequencies selected.

3.3.1.1.2.14.1.2 PTT for Split Operations - When a frequency is operating in the split mode and a PTT signal is activated at a position for that selected frequency, only that frequency is locked out to PTT at other positions with that frequency selected.

3.3.1.1.2.14.1.3 Multiple Transmission at a Position - When more than one frequency has been selected at a position and more than one frequency has its transmission capability enabled and the PTT is keyed at the position, the switching function shall provide PTT signaling and voice for each frequency to the radio interface or BUEC interface, whichever is enabled on each frequency. The VTABS shall be capable of concurrent transmission from a position for up to 24 frequencies.

3.3.1.1.2.14.1.4 PTT Lockout - Except cases where PTT preemption is permitted by classmark, an attempt by a position operator to transmit on a frequency currently being used for transmission (PTT active) by another position operator shall cause a PTT lockout of that frequency at the attempting position. The position operator at the attempting position shall be provided a visual and an audible indication that the transmission on the frequency has been locked out. A unique PTT lockout visual indication shall be displayed on the frequency(ies) associated with the lockout. The visual indication shall remain for the duration of the lockout. In addition, the frequency(ies) being locked out, to a maximum of four, shall be displayed in any order in the message area for three seconds, unless overridden by a subsequent message. This display shall time out in three seconds. The frequency characteristics of the PTT lockout audible indication shall be the same as for VSCS. The PTT lockout tone shall be distinct from the OVR tone and tone accompanying textual messages. The PTT lockout audible indication shall be supplied only to the A/G loudspeaker for the duration of the PTT lockout on that frequency. PTT shall not be locked out on other frequencies selected for transmission at the positions that are not currently being used for transmission by other position operators.

3.3.1.1.2.14.2 PTT Preemption - Every frequency assigned to an air traffic controller position shall be classmarked as either possessing or lacking PTT preemption relative to that position's use of the frequency. A PTT action by the position operator activating transmission on a frequency designated as preempting shall cause the termination of any transmission in progress on that frequency at any other air traffic controller position. The position operator at a position whose transmission has been preempted shall receive a distinct visual indication on the affected frequency(ies) that preemption has occurred, and shall be provided the preempting conversation(s).

Upon PTT preemption, the position operator whose transmission has been preempted shall also receive an audible indication that preemption has occurred. The audible indication shall be rerouted only to the headset. The frequency characteristics of the tone shall be identical to that used for PTT lockout, but the duration shall be the same as for VSCS. PTT preemption, if actuated, shall be noncontendable, even by positions processing the same frequency's PTT preemption classmark.

3.3.1.1.2.14.3 Radio Interface PTT Trunk Lockout - For radio interfaces that provide a PTT Trunk Lockout signal, the VTABS shall provide a distinct visual indication and an audible indication, at an operational position attempting PTT, of a radio interface that is providing the PTT Trunk Lockout signal. A unique PTT trunk lockout visual indication shall be displayed on the frequency associated with the lockout(s). This visual indication shall remain for the duration of lockout. In addition, the frequency(ies) being locked out, to a maximum of four, shall be displayed in any order, along with a trunk lockout message in the message area for three seconds, unless overridden by a subsequent message. This display shall time out in three seconds. The audible indication shall be supplied continuously to the position for the duration that PTT is attempted on that frequency. The frequency characteristics of the PTT trunk lockout audible indication shall be identical to that used for PTT lockout.

3.3.1.1.2.14.4 Radio Interface PTT Lockout - The PTT lockout requirements shall apply only for those configurations where multiple operational positions have access to a given assigned frequency through a single radio interface. The PTT lockout requirements shall not apply to a given assigned frequency at multiple operational positions accessing the given frequency through separate radio interfaces.

3.3.1.1.2.14.5 PTT Receiver Muting - During the time that PTT is active for a radio frequency, all received radio voice for that frequency will be completely muted at the radio interface. This function shall also apply when the frequency has been selected on BUEC. For radio interfaces that provide a PTT Trunk Lockout signal, if a PTT Trunk Lockout signal is received from the radio interface while PTT is active, the received radio voice path shall be enabled.

3.3.1.1.2.14.6 PTT A/G Carry Over - Once a PTT has been established for an A/G call , selection of a new transmitter site within a multiple site group without releasing PTT shall cause voice transmission over the newly selected site in addition to all other A/G frequencies with transmitters enabled.

3.3.1.1.2.14.7 A/G Voice Reception - The switching function shall recognize a squelch break signal from the radio interface that provides a squelch break signal and shall provide that signal to all positions that have the frequency assigned. For BUEC interfaces and radio interfaces that do not provide a squelch break signal, the VTABS shall recognize voice signals from the interfaces as squelch break and shall internally generate the squelch break signal. The presence of the squelch break signal is to indicate that the receiver has been activated and is receiving a radio signal.

3.3.1.1.2.14.7.1 Multiple Receptions at a Position - When more than one frequency has been selected at a position and more than one frequency has its voice reception capability enabled, and multiple voice receptions occur simultaneously for any of those frequencies, the switching function shall provide the signaling and voice for each frequency to the position from either the radio interface or the BUEC interface, whichever is enabled on each frequency. The VTABS shall be capable of receiving voice concurrently at a position for up to 24 frequencies.

3.3.1.2 VTABS Operational Position G/G Communications

3.3.1.2.1 General VTABS G/G Requirements - Each air traffic controller operating position within the VTABS Training and Backup subsystem shall be provided the capability for assignment of G/G communications functions. Assignment of a G/G communications function at a given air traffic controller position shall be controlled by configuration maps as determined by site adaptation data. The VTABS position and switching subsystem shall provide the G/G communications functions through each of the trunk interface types supported by the VSCS. G/G communications shall include, but not be limited to, the following:

a. Call types.

   1. Intercom.
   2. Interphone.

b. Call modes.

   1. Direct access.
   2. Indirect access.
   3. Voice calls.

c. Call features.

   1. Override.
   2. Hold.
   3. Forwarding.
   4. Reserved.
   5. Conferencing.
   6. Common Answer (CA) queuing.

7. Call release.
8. Routing of incoming G/G calls to HS or G/G LS.
9. Routing of incoming G/G OVR calls to HS or G/G LS.
10. Recording of position relief briefings.
11. Position voice monitoring.
12. PTT.
13. Manual ring assignment.
14. Call Pickup.

3.3.1.2.1.1 Intercom/Interphone (IC/IP) - The VTABS shall provide each operational position the IC/IP communications. Access to each of these shall be determined by configuration database map(s) for the positions. Call mode and call feature restrictions shall be controlled by classmarks assigned by authorized personnel and resident in the position maps.

3.3.1.2.1.2 Routing of Incoming G/G Voice - The VTABS interactive display shall provide separate HS/LS routing selectors for incoming OVR calls and for incoming non-OVR calls. For any G/G calls directed to a position not in a current configuration map, the system shall automatically route the call to a currently designated mapped position in the position configuration map.

3.3.1.2.1.2.1 Selection of G/G Voice Routing - The position operator shall be able to select the routing of the incoming OVR voice communications path with a single touch action. The position operator shall be able to select the routing of all other incoming G/G voice communications with a single touch action. Successive touch actions for either selection shall toggle the routing between the G/G LS at the position and the HS(s) at the position.

3.3.1.2.1.2.2 Indication of Voice Routing - The position operator shall be provided with continuous visual indication of the current selected G/G incoming voice communications path routing to either the G/G LS or the HS(s) at the position for both incoming OVR communications and "all other" incoming G/G communications.

3.3.1.2.1.2.3 Incoming G/G Call Indication- -All incoming G/G calls shall be indicated by a distinct visual and audio indication. Visual and audio indications for incoming override calls shall be as specified in 3.3.1.2.2.5.2. Visual and audio indications for incoming non-override calls shall be as specified below.

3.3.1.2.1.2.3.1 Visual Indications For Incoming G/G Calls - All incoming G/G non-override calls shall be indicated by a distinct visual indication at the appropriate touch response area/call designator. If the DA for a calling party is on an undisplayed G/G page, a visual indication of the incoming call shall be provided on a current page.

3.3.1.2.1.2.3.2 Audio Indications For Incoming G/G Calls - All incoming calls, except overrides and voice calls, shall be indicated by sounding the chime at the called position, if it has been enabled by the position operator. Except where otherwise specified, the chime shall sound until the call is answered or the calling party disconnects. For incoming IP calls, on trunk types that do not have supervisory signaling, a call that is not answered within a suitable timeout period shall be automatically disconnected.

3.3.1.2.1.2.4 Position Relief Briefing Recording - The VTABS shall provide for the recording of position relief briefings between the operator going off duty at a position and the operator assuming duties at that position. While the position relief briefing recording function is active, all conversation between the two or more operators at the position shall be recorded in accordance with the VSCS-REC IRD. Activation of the position relief briefing recording function shall in no way interfere with incoming or outgoing A/G or G/G transmissions at the position. During a position relief briefing, audio sidetone shall be provided to all jacks at the position.

3.3.1.2.1.2.4.1 Position Relief Briefing Recording Activation - The prerequisite for activation of position relief briefing recording at a position shall be headsets plugged into any two (or more) of the four position jacks. The position relief briefing recording shall then be activated by a single touch action by the position operator. A continuous visual indication shall be provided for the duration of the position relief briefing. Position relief briefing recording shall be deactivated by a single touch action by the position operator or by the removal of all but one headset from the position jack modules.

3.3.1.2.1.2.5 Position Voice Monitoring - The VTABS shall provide the capability to allow any operational position to activate and disable voice monitoring of A/G voice communications only. The monitoring position shall hear all incoming A/G communications for frequencies which have HS routing selected at the monitored position, regardless of the effect of auto transfer of A/G voice routing and all outgoing A/G communications at the monitored position. The monitoring position shall not hear incoming A/G communications for frequencies which have LS routing selected at the monitored position. The VTABS shall provide a position classmark (for each logical position) which will permit either A/G voice monitoring, both A/G and G/G voice monitoring or A/G and two -way incoming OVR voice monitor depending on the classmark activation, and the restrictions of paragraphs 3.3.1.2.1.2.5.1, 3.3.1.2.1.2.5.2, and 3.3.1.2.1.2.5.3.

The VTABS shall provide the capability for any operational position to concurrently monitor all voice communications directed to the headsets of up to 9 other positions within a facility and all voice communications transmitted by the monitored position(s) subject to the restrictions in 3.3.1.2.1.2.5.3. Tones generated locally by the monitored position(s) shall not be mixed into the monitored voice audio signal(s). Access to position voice monitoring at designated positions shall be defined and restricted by classmarks assigned by authorized supervisory personnel and resident in the configuration database map(s) for the position.

3.3.1.2.1.2.5.1 Position Voice-Monitoring Restrictions - Position voice-monitoring of any operational position by any other operational position shall in no way alter or degrade A/G or G/G communications at the monitored position. The operational position being monitored shall receive no visual, audible, or other indication that the position is being monitored. When the monitored position is operating in position split functionality mode, VTABS shall provide the capability to monitor all A/G voice communications, directed to and emanating from the headset plugged into the A/G dual jack module at the monitored position. The operational position monitoring a position operating in position split functionality mode, shall receive no indication that the monitored position is in position split functionality mode.

3.3.1.2.1.2.5.2 Position Voice-Monitoring Access - Access to position voice monitoring at an air traffic controller position shall be provided by DA or IA. DA position voice-monitoring shall be provided by a single touch action to an appropriately marked and classmarked DA designator. IA position voice monitoring shall be provided, position classmark permitting, by entering the position voice-monitoring function code, then entering the number of the position to be monitored. Position voice monitoring shall be suspended if the monitoring position initiates any A/G or G/G communication, answers G/G communications, or enables the radio transfer function. Position voice monitoring shall be suspended, classmark permitting, while a monitoring position is overridden or if position voice monitoring is initiated while a position is overridden. Position voice monitoring, if selected, shall be resumed after termination of the communication or action causing the suspension. Position voice monitoring shall not be suspended when the monitoring position receives an incoming A/G call.

Position voice monitoring shall be terminated by individually terminating each active voice-monitoring selection. Additionally, all active voice-monitoring selections shall be terminated when the monitoring position becomes inactive. While the position voice-monitoring function is active, the position operator at the monitoring position shall be provided a continuous visual indication that position voice monitoring is in progress, along with the designation of the position being monitored.

3.3.1.2.1.2.5.3 Position Voice Monitor Loop Closure - The VTABS shall provide internal controls to prevent closure of voice monitored positions. An operational position shall not be permitted to establish a voice monitor that would result in the position being monitored by itself due to voice monitor chaining. When a position that is being monitored attempts to initiate a voice monitor to another position that already has an active voice monitor, that position monitor shall be disallowed and the position operator shall be provided a notice that the voice monitor is not allowed due to monitor loop closure constraints.

3.3.1.2.1.2.5.3.1 Override/Monitor Loop Closure - When an operational position that has an active voice monitor is overridden by another position, the overriding position shall not hear the overridden position's monitor audio, thus preventing audio loop closure.

3.3.1.2.1.2.6 PTT for G/G Communications - All voice transmission of G/G communications at an operational position using latching DA activators shall be enabled only by either a hand-activated or foot-activated PTT device. For G/G calls requiring PTT, no voice or other signal shall be transmitted from the position over G/G unless PTT is activated at the position.

3.3.1.2.1.2.6.1 PTT for G/G DA - DA call activations that require PTT shall emulate either a latching or non-latching push-button. PTT activation shall be required to transmit voice on the circuit, and call release shall be effected as described in 3.3.1.2.2.2. For the time interval that the G/G PTT feature is enabled at a position with A/G communications enabled, the PTT shall not cause transmission of voice on any frequencies selected at that position. Release of the G/G call shall not reenable the PTT feature for A/G communications.

3.3.1.2.1.2.6.2 PTT Carry Over - Placing or answering a subsequent G/G call without releasing PTT from a previous G/G call shall cause voice transmission over the subsequent G/G call. Once a PTT has been established causing voice transmission over A/G frequencies, placing or answering a G/G call without releasing PTT shall cause voice transmission over the G/G call and termination of the A/G transmissions.

3.3.1.2.2 IC/IP - The VTABS shall provide an IC to permit any operational position within a facility to establish voice communications with any other position within that facility. The VTABS shall provide an IP to permit any operational position within a facility to establish voice communications to any position at another facility. Access to IC and IP communications at an operational position shall be through DA or IA, or both.

3.3.1.2.2.1 Active IC/IP Calls - A position active call is an IC/IP call that a position operator can release by a single touch action at the position. Monitoring, incoming OVR calls, and calls in a HOLD status are not, by this definition, position active calls. An operational position shall be permitted to engage in only one position active call at a time. Initiation of an IC/IP call by DA or IA shall cause the release of any position active calls in progress at the position.

3.3.1.2.2.2 Call Disconnection - Position active calls shall be disconnected by any operator release method defined in the following paragraphs. Additionally, a position active call shall be disconnected when the position becomes inactive, that is when the last remaining voice input device (i.e., headset or handset) is removed from the position jacks.

3.3.1.2.2.2.1 Call Release Designator - Position active calls shall be disconnected by a single touch action of the call release designator.

3.3.1.2.2.2.2 DA Call Designator Release - Position active calls shall be disconnected by a single touch action to the active latching DA call designator, by cessation of touch to the non-latching DA call designator, or by a single touch action to the active call designator in the incoming Common Answer (CA) queue area.

3.3.1.2.2.2.3 Release by Initiating a Call - Position active calls shall be disconnected by the initiation of another DA or IA call at the position.

3.3.1.2.2.2.4 Release by Answering a Call - Position active calls shall be disconnected by any touch action required to answer an incoming call at the position.

3.3.1.2.2.2.5 Release by Resuming a Call - Position active calls shall be disconnected by any touch action that resumes a call that had previously been placed on HOLD.

3.3.1.2.2.2.6 Release Indications - Indication of call release shall be provided to a position operator by the cessation of any BLINK or other active call status indication.

3.3.1.2.2.2.7 Last Party Release - For intra-VTABS calls, for VTABS calls to and from interfacing systems and inter-VTABS calls on trunks equipped with appropriate signaling, the VTABS shall provide disconnection of a G/G call when, with the exception of OVR calls and meet-me conferences, either of the last two parties on the call performs any of the release actions outlined. The remaining party on the call shall not be required to take any action to disconnect the call. The VTABS shall recognize disconnect signals where provided by other interfacing systems.

3.3.1.2.2.3 Direct Access (DA) - All IC and IP circuits shall be accessible via DA. Each access via DA shall require a single touch action by the position operator to initiate or terminate a call. Each operational position shall be provided the capability to access at least 50 DA G/G circuits. The actual number of DA circuits that may be used at an operational position shall be determined by DA assignments in the position's configuration map(s).

3.3.1.2.2.3.1 DA Calls - The switching and control functions shall provide connectivity from the display function for DA (both IC and IP) calls by converting the call processing address digits of the desired destination into the appropriate connections. The call processing sent to the called party shall include call feature information. Except for incoming OVR calls and calls in HOLD, DA call selection shall release the position from a previous IC or IP call and establish a DA path to the new position.

3.3.1.2.2.3.1.1 Number of DA Selectors - The VTABS display function shall provide at least 50 DA communication selectors at each operational position, DA selectors, their functions, and limitations shall be assigned to each operator position in the position configuration map(s). DA identifiers, functions, and limitations shall be defined by classmarks resident in the configuration database maps for the operational positions.

All assigned DA selectors, or a minimum of 25, whichever is less, shall be immediately available for selection at any time.

3.3.1.2.2.3.2 Latching/Nonlatching DA Actions - Each DA selector at an operational position shall be assigned a classmark designating the selector as either latching or nonlatching, except voice monitor DAs, which can only be latching. A latching selector shall require a touch action to activate the selector; a second touch action or other call release shall be required to deactivate the selector. A nonlatching selector shall require a continuous touch action to initiate and maintain activation of the selector; cessation of touch shall deactivate the circuit. A continuous visual indication shall be provided showing that a selector is latching or is nonlatching. Activation of a nonlatching selector shall activate the position microphone for the duration of the touch action.

3.3.1.2.2.3.3 Calling Party DA - For a DA call, DA actuation at the position shall cause switch connectivity to be established to the called position. For an IP DA call, DA actuation at the position shall initiate the seizure of the appropriate trunk. A ringback tone signal shall be furnished to the calling position except for voice calls, OVR, and trunk types 3, 4/5, and type 5. A signal shall be sent to sound the chime at the called position.

3.3.1.2.2.3.4 Called Party DA - When the called party answers, the ringback tone to the calling position shall cease, and the communication link shall be completed.

3.3.1.2.2.4 Indirect Access (IA) - Both IC and IP circuits shall be accessible via IA. IA requires using the IA keypad to initiate a call or a control function.

3.3.1.2.2.4.1 IA Call Initiation - Any IA call from a position shall be initiated by activating the IA keypad, then entering the number sequence for the desired call destination.

3.3.1.2.2.4.1.1 IA Access Keypad Enable - The IA keypad device shall be manually enabled for input by activation of an IA or equivalently marked key. In addition to manual activation, the IA keypad shall be automatically enabled in response to a user request for a function or call type that requires an IA dial sequence to complete the request. Upon manual or automatic enabling of the IA keypad, the push-buttons shall become backlit as visual indication that the IA keypad is active for input. Audible feedback, such as a dialtone, shall not be used to indicate the IA keypad is active for input. Enabling the IA keypad shall clear any previous entries and status messages that may be present on the keypad alphanumeric display, and shall cause a reset for any number sequences that may have been entered prior to re-enabling.

3.3.1.2.2.4.2 IA Call Timeout - The IA keypad shall be disabled for acceptance of input if 15 seconds have elapsed since activation of the IA keypad or since the last digit was entered, whichever is later, prior to a complete dialing sequence being entered, or upon completion of a dialing sequence. When the destination, identified by the number sequence, is an IP circuit that requires additional dialing, the IA Keypad shall remain enabled and the timeout and automatic disable features shall not apply.

3.3.1.2.2.4.3 Common Answer (CA) Queue - An incoming call (IA or DA) to an operational position that does not have a corresponding latching or non-latching DA touch area for answering the call (where answering is required) shall be directed to the called position's CA queue; otherwise, the capability for answering the call shall be provided at the appropriate DA selector. The ringback tone shall cease when the call is answered.

3.3.1.2.2.4.3.1 CA Queue Call Answer Features - The position operator shall have the capability to select any call in the answer queue in any order for answering, and to cause the automatic selection of the pending call that has been in the CA queue for the longest time.

3.3.1.2.2.4.3.2 Caller Identification (ID) - For an incoming call to an operational position that does not have a corresponding DA touch area, the VTABS position designator of the call source shall be displayed on the G/G communications CA queue display area of the called position. Where call source information is not available, the line/trunk designator for that incoming call shall be displayed on the CA queue area. Caller IDs displayed in the CA queue area shall not be shifted from one displayed queue position to another as a result of any changes in the number of calls in the queue. The CA queue area shall be capable of displaying at least 12 alphanumeric characters in each queue position.

3.3.1.2.2.4.3.3 CA Queue Depth - Provision shall be made to accommodate up to four calls in the position CA queue, including an active CA queue call and queue calls on HOLD. When the answer queue is full, incoming calls that would normally be directed to the position CA queue shall not be connected.

3.3.1.2.2.4.3.4 Called Party CA Busy - When four calls are in the queue, or when three calls are in the queue and there is an active CA call at the called position, a busy tone shall be sent to the current calling position.

3.3.1.2.2.4.3.5 IA Call Exception Conditions - If an invalid number is dialed, an interrupted constant frequency tone shall be sent to the calling party by the terminating switch for IP calls and the error message tone shall be sent to the calling party by the local switch for IC calls, which shall continue until the IA call is released by the calling position.

3.3.1.2.2.4.3.6 IA Release - Release of an IA call by the calling party shall cause the indication of that call to be cleared from the called party CA queue and the communication path to be disconnected. No other calls in the queue shall be affected. Any CA calls released by the calling party shall cause the disconnection of the communication path from that calling party only.

An actuation of the CA feature at the called position shall release any active call. Alternative methods for release shall be by initiating or answering any other IC or IP call. If the IA control is pushed to release from an IA call, the call shall be released. Another operation of the IA push-button shall be required if another IA call is to be made.

3.3.1.2.2.5 OVR - The VTABS shall establish the connectivity for an IC call between calling and called parties with no actions being required by the called party to answer the call. The OVR connectivity shall be in addition to any current communication connectivity at the called position. The OVR calling party shall join in any ongoing G/G communications at the called position. The OVR calling party shall receive, over the OVR voice channel, all A/G communications emanating from the called position, and all A/G and G/G communications directed to the called position that are routed to the called position's HS. The OVR calling party's voice shall not be transmitted over the called position's A/G communications.

When the overridden position is operating in position split functionality mode, the OVR calling party shall receive the following A/G and G/G communications:

a. All G/G communications emanating from or directed to the overridden position's G/G dual jack module that are routed to the called position's HS plugged into the G/G dual jack module.

b. When A/G monitoring is active (enabled but not suspended), all A/G communications emanating from or directed to the overridden position's A/G dual jack module that are routed to the HS plugged into the G/G dual jack module.

3.3.1.2.2.5.1 OVR Signaling - After the connection has been made, an audible signal shall be provided to both the calling and called positions to indicate that the OVR connection is complete. The audible signal shall be for all override calls.

3.3.1.2.2.5.2 OVR Call Indications - The VTABS shall provide an audible tone and a visual indication of an incoming OVR call at an operational position. A visual indication and an identical audible tone shall be provided to the position operator at the called position for any additional incoming OVR calls. In the case that a position is overridden by six (6) or more positions, the overridden position's override list shall display the caller IDs of the first five (5) overriders in the order in which the OVR calls were received. When one or more of the first five (5) overrides releases, the override list shall be updated to include the override caller ID(s) of the next overrider(s) as determined by the order in which the calls were received. The VTABS caller ID(s) of the overriding caller(s), up to five (5), shall be displayed at the called position for the duration of the OVR call(s). The frequency and duration of the OVR tone shall be the same as for VSCS. The VTABS shall provide a distinct visual indication of an active override to all positions with the OVR DA button for the primary designation of the called position. This visual indication shall be provided for the duration of the override call.

3.3.1.2.2.5.3 DA OVR - The VTABS shall provide each operational position the capability of placing IC DA OVR calls to any other operational position for which the calling position has DA OVR assignments. The DA OVR assignments at a given operational position shall be as defined by the configuration map(s) for that position. DA OVR calls shall be disconnected (released) by the calling party only; an overridden party shall neither be required nor permitted to disconnect any incoming OVR call.

3.3.1.2.2.5.3.1 DA OVR Call Initiation - The VTABS shall provide for DA OVR calls to be initiated at a position using either latching or nonlatching touch activation. DA selectors shall be distinctly marked to indicate their OVR capability.

3.3.1.2.2.5.3.2 Nonlatching DA OVR Call Initiation - DA OVR calls classmarked to require nonlatching touch activations shall be initiated by the touch action and released by cessation of the touch action; the position microphone of the position headset/handset shall be active for the duration of the touch action.

3.3.1.2.2.5.3.3 Calling Party DA OVR - When a DA assigned the OVR feature is actuated, the connectivity to the called position shall be established by the switching and control functions. When the DA is classmarked to require G/G PTT, the position shall continue to use PTT with the overridden position even after being itself overridden by a third position.

3.3.1.2.2.5.4 IA OVR Calls - The VTABS shall provide for the capability of initiating OVR calls using IA from any operational position as permitted by classmarks. The voice of the overriding party shall not be transmitted over any A/G communications in progress at the overridden position. IA OVR shall be initiated by entering an OVR function code, or equivalent, preceding the dialing sequence. Answering of OVR calls initiated by IA shall be as described for answering OVR calls.

3.3.1.2.2.5.5 Initiating Calls During an OVR - The switching and control functions shall provide the necessary capability such that the receipt of an OVR call at a position shall not inhibit the position from placing an IC, IP, or A/G call while being overridden.

3.3.1.2.2.5.6 Simultaneous OVR - The capability and resources shall be provided by the VTABS for any operational position to be simultaneously overridden by up to nineteen other positions. The first nine positions overriding a single position shall form an OVR conference. Further attempts to override the position shall not be blocked, but shall be established from the overriding position to the overridden position as a two-party OVR call.

If any of the parties overriding a single position are themselves being overridden, all parties shall be connected to form one composite OVR conference call.

As each simultaneous OVR conference call reaches the simultaneous OVR limit, an alert indicating that an OVR conference resource is not available shall be sent to the maintenance and NAS Manager position, as designated.

3.3.1.2.2.5.6.1 Simultaneous OVR Conference Limitation - The limit of the number of positions involved in a simultaneous OVR shall be at least six (6), including the overridden position. A capability shall exist within the VTABS for at least 32 simultaneous OVR conferences.

3.3.1.2.2.5.7 Override Loop Closure - The VTABS shall provide internal controls to prevent audio feedback due to closure of chained override calls involving three (3) or more positions. Position-to-position override calls shall not be permitted to form a closed audio loop with other positions. When a position operator at the operational position attempts to initiate an override call that would result in loop closure the VTABS shall break any audio paths that will result in audio feedback in the loop. Two party override loops shall be prohibited provided the denied overrider receives notification of the reason for denial.

3.3.1.2.2.5.8 OVR Release - When the calling party disconnects from an OVR call, the switching and control functions shall take down and release all resources used for that call.

3.3.1.2.2.6 Call HOLD - The VTABS shall provide the capability for a position operator to place a position active call, including conference calls but excluding OVR, voice calls, and non-latching DA calls in a HOLD status with a single touch of the HOLD area. The position operator shall be provided a continuous visual indication of the call indicator at the operational position that a call is in a HOLD status for the duration of time that a call is on HOLD. A CA queue call placed on HOLD shall retain its position in the CA queue. An IA call placed on HOLD shall be moved to the CA queue providing that a CA queue space is currently unused; otherwise, hold shall be denied, and appropriate notification shall be given to the position operator.

3.3.1.2.2.6.1 Resuming Call on HOLD - The position operator shall be provided the capability to resume a call on HOLD by a single touch action to the call designator for the desired call. Resumption of a call on HOLD shall cause the disconnection of any position active calls that may be in progress. Automatic call answer queue selection shall not affect CA queue calls on HOLD.

3.3.1.2.2.7 Call Forwarding - The VTABS shall provide the capability of any position operator to enable the call forwarding feature for that operational position. All G/G calls, except voice calls, directed to a position with the call forwarding feature enabled shall be redirected to a designated destination position within the facility. Call forwarding shall not affect the continued use of any A/G functions at the operational position. Call forwarding shall be restricted to forwarding to operational positions within the same facility. A position having once initiated call forwarding shall automatically be released by the VTABS from receiving subsequent G/G calls.

3.3.1.2.2.7.1 Enabling Call Forwarding - A position operator shall be provided the capability to enable call forwarding at an operational position. The forwarding destination shall be designated by a single touch action to a DA designator for the destination position, or by entering the destination Position number on the IA keypad.

3.3.1.2.2.7.2 Disabling Call Forwarding - A position operator shall be provided the capability of disabling the call forwarding function at an operational position by using an IA code. Additionally, if no forwarding destination is designated within 10 seconds after enabling of the call forwarding function at an operational position, or if any other G/G function is selected, then the call forwarding function shall be disabled. Call forwarding discontinuance shall be controlled by the initiating position or by the supervisory or maintenance and NAS Manager positions classmarked for that capability.

3.3.1.2.2.7.3 Call Forwarding Indications - For the duration of time that call forwarding is in effect at an operational position, a message shall be provided on the G/G display at the position indicating that call forwarding is in effect with the designator of the destination position. The cognizant area supervisor shall be provided an indication when an operational position has enabled call forwarding, and when that position subsequently disables call forwarding.

3.3.1.2.2.7.4 Call Forwarding Closure - The VTABS shall provide internal controls to prevent closure of call forwarding. Position-to-position call forwarding shall not be permitted to form a closed forwarding loop. An operational position shall not be permitted to be the ultimate recipient of its own call forwarding. The position operator at the operational position attempting to enable call forwarding that would cause closure shall be provided a notice that forwarding to the designated position is not allowed due to forwarding closure.

3.3.1.2.2.7.5 Call Forwarding Chains - The system shall not restrict the use of call forwarding under any conditions except those detailed in 3.3.1.2.2.7.4. In particular, a position to whom another position or positions have forwarded their calls shall be permitted to forward its calls, thus creating a call forwarding chain, provided the restrictions in 3.3.1.2.2.7.4 are not violated. Similarly, the system shall permit call forwarding chains created when a position forwards its calls to a position whose calls are already forwarded, provided the restrictions in 3.3.1.2.2.7.4 are not violated. In the case of call forwarding chains, the system shall direct calls in accordance with the chain; that is, calls addressed to a position whose calls are forwarded shall be directed to the ultimate position in the chain, rather than the next position in the chain.

3.3.1.2.2.8 Conference Calls - The VTABS shall provide the capability for any position operator to initiate and participate in conference calls, up to the 10 simultaneous conferees. The number of simultaneous conferences capable shall be at least 16. Conference calls shall not be limited by the number of OVR calls or voice calls within the VTABS. Three types of conference capabilities shall be provided: progressive Conferencing, meet-me conferencing, and preset conferencing. Access to conferencing capabilities at an operational position shall be defined and limited by classmarks in the position map(s) for the position. IA and DA access to conference calls shall be provided. A visual indication of participation in a conference call shall be provided to each position operator while active in a conference. Additionally, IC conferees shall be provided an indication that an incoming call is a conference call prior to answering the call.

3.3.1.2.2.8.1 Progressive Conferencing - The VTABS shall provide the capability for authorized operational positions to initiate progressive conferences by a single touch action or by entering an appropriate IA function code sequence, or both. All non-OVR IA and non-OVR DA calls initiated at the operational position where the conference function is enabled, and answered by the called positions, up to the conference limit of the VTABS or of the position, whichever is less, shall become participants in the conference call. After selecting a conferee via DA, the system shall permit the originator to select the next DA or IA conferee without waiting until the previous conferee has answered. After selecting a conferee via IA, the system shall permit the originator to select the next DA conferee without waiting for the previous conferee to answer. The originator shall be provided the means to cancel any selected conferee who has not yet answered the call.

3.3.1.2.2.8.2 Meet-Me Conferencing - The VTABS shall provide the capability for operational positions to participate in meet-me conferences by a single touch action or by entering an appropriate IA function code sequence, or both. A conference bridge, or equivalent, with the feature that any operational position, up to the conference limit of the VTABS, accessing the bridge becomes party to any conference on the bridge, shall be provided. When a meet-me conference is active, any non-participating position with a DA for the conference shall receive an appropriate circuit-in-use indicator.

3.3.1.2.2.8.3 Preset Conferences - The VTABS shall provide for the identification and inclusion of preset conferences in an operational position's configuration map(s). Conferees shall be identified within the position map(s). Position operators shall not have the capability of modifying the conferee list. Preset conferences shall be accessible for initiation by an authorized position operator by DA initiation. A preset conference shall provide ringdown access to the conferees. Each called party, up to the VTABS conference limit, shall be able to join the conference by answering the call.

3.3.1.2.2.8.4 Conference Features - For progressive conference calls, an indication shall be provided to the conference initiator when the conference limit is reached. For progressive and preset conference calls, the VTABS shall terminate the call attempt to any party that does not answer within a suitable timeout period. Audio ringback shall be provided to the originator of a progressive or preset conference and shall terminate when any one conferee answers the call. For any type conference, an indication shall be given to any position operator attempting a conference when no system conference resources are available.

3.3.1.2.2.8.5 Conference HOLD - The VTABS shall provide the capability for any participant in a conference call to suspend participation in the conference call by activation of the HOLD function at the position. Activation of the conference HOLD function shall not affect the continued participation in the conference by any other operational position. The VTABS shall provide the capability for a position operator to answer any incoming G/G communication while the position is in a conference HOLD status. A continuous visual indication (Wink) of the conference selection indicator shall be provided for the duration of time that the conference is active and the position conference HOLD is in effect at an operational position. Participation in the conference call at an operational position shall be resumed by a single touch action to the Winking conference selection indicator.

3.3.1.2.2.8.6 Release From Conference - Any participant in a conference call shall be provided the capability to release from the conference call at any time, without affecting the continued participation in the conference by any other operational position.

3.3.1.2.2.9 Position Voice Monitoring - The VTABS shall recognize a request for monitoring from the entry/display function and shall establish the connectivity to the position to be monitored. There shall be no monitored transmission-level change on any connection established at the monitored position.

3.3.1.2.2.10 G/G IP Trunk Features

3.3.1.2.2.10.1 Trunk Signaling Interfaces with Existing Systems - The VTABS trunk interface, as specified in the VSCS-Trunks ICD (VS-I-01) and its implementation is documented in the VSCS Trunks ICD (179656), when appropriately classmarked and equipped with appropriate equipment, shall be capable of interfacing with the existing G/G trunks provided by the VSCS. The VTABS shall provide the capability for each of the following trunk types and provide the required signaling:

a. DA voice call signaling (type 9).
b. Selective signaling (type 5).
c. Immediate dialing (type 7).
d. Selective signaling in, voice call signaling out (type 4).
e. Selective signaling in, voice call or selective signaling out (type 4/5).
f. Ringdown signaling (type 3 20 Hz Ringdown)
g. Loopstart signaling (type 3 loopstart)
h. Tone Burst signaling (type 3 tone burst)
i. CO/PABX signaling (type 6).
j. Local dial line signaling (type 8).

3.3.1.2.2.10.1.1 Voice Calls - The VTABS shall provide the capability for designated operational positions to initiate voice calls by DA, or by entering an appropriate IA function code sequence. Incoming voice calls shall be heard on the G/G LS at all those operational positions that are on the voice call circuit. A unique, distinct visual indication identifying the voice call shall be provided on a DA selector at each called position on the voice call circuit. When the voice call is answered by operation of any DA voice call control for that circuit, the applicable switching and control functions shall signal all positions served by the voice circuit that the call has been answered. Connectivity shall be established by the switching function only to the answering position. Any position with DA access to this busy trunk shall be capable of joining on a Conferencing basis. The sixth position attempting to join the voice call shall receive a busy signal.

Operational positions shall be provided the capability to enable and disable incoming voice at the G/G LS (i.e., the voice page) on any or all individual voice call circuits assigned to the operational position. Enabling or disabling of the voice page for a voice call circuit at one position shall not affect receipt or routing of audio on an active voice call circuit (i.e., after an incoming voice call is answered). Enabling or disabling a voice page shall be performed via selection of a function key on the interactive display, followed by a touch to the desired voice call DA. A visual indication of the enabled or disabled voice page shall be provided on the DA selector.

Access to voice call circuits shall be as determined in the position configuration map(s) from site adaptation data. The maximum number of positions capable of simultaneously accessing an outgoing voice call trunk shall not exceed five at any facility. Incoming IP voice calls shall be assignable to positions or group of positions within a facility. A capability shall exist within the VTABS for at least 100 voice call trunks.

3.3.1.2.2.10.1.1.1 Voice Call Signaling - The switching and control functions shall detect an incoming voice call by the presence of incoming voice signals on the line. Detection of voice signals below the threshold shall not cause the VTABS to respond to the signals. The threshold shall be -26 dBm0 (nominal test level).

3.3.1.2.2.10.1.1.2 Voice Call Indications - The VTABS shall provide a visual indication to all called parties on a voice call circuit until at least one party answers the call. Every position that answers the voice call shall be provided a distinct visual indication of participation in the voice call for the duration of time that the position is participating in the voice call. After any position on the voice call circuit answers the call, then all other operational positions on the voice call circuit that have not answered (or have answered and released) the voice call shall be provided a distinct visual indication (STEADY) of the continued use of the voice call circuit for the duration of time that the circuit is still active.

3.3.1.2.2.10.1.1.3 Answering Voice Calls - The VTABS shall provide the capability for the position operator at any called position on a voice call circuit to answer the voice call by a single touch action to the voice call indication at a called position. A distinct visual indication of voice trunk in use shall be provided to all positions within the facility of the voice call initiator with access to the voice trunk for the duration of time that the trunk is in use. When a voice call is answered, the voice path for the voice call at an answering position shall be directed to the selected G/G incoming voice path routing at that position, and removed from the G/G loudspeakers at all positions on the voice call circuit. Any position operator on the voice call circuit shall have the capability to join the voice call in progress, while the voice call circuit is active, by a DA touch action.

3.3.1.2.2.10.1.1.4 Release From Voice Calls - Each active participant in the voice call, except the last participant, shall be required to release from the voice call by any of the defined disconnect methods. For inter-VTABS voice calls, the VTABS shall provide disconnection of the last participant when either of the last two parties on the call performs any of the release method.

3.3.1.2.2.10.1.2 Selective Signaling - The switching and control functions shall provide the capability to both receive telephone calls and originate calls to existing systems equipped with selective signaling systems. The switching and control functions shall make the necessary code translations to be compatible with the numbering plan used in the VSCS system. The switching and control functions shall include the capability to emulate all signals for IP trunks to interface existing systems.

3.3.1.2.2.10.1.2.1 Selective Signaling Trunk Circuits - The VTABS shall provide the capability for G/G IP access, for any trunk that utilizes selective signaling, to up to 9 operational positions. Any position operator on such a selective signaling trunk circuit shall have the capability to join a call in progress on the selective signaling trunk circuit, while the selective signaling trunk circuit is active, by a DA touch action or IA dial sequence.

3.3.1.2.2.10.1.3 Manual Ring Circuits - For those calls initiated at an operational position on lines requiring manual ring, the VTABS shall provide the capability for the calling position operator to invoke the manual ring by a nonlatching touch action. The manual ring feature shall be available at all times during the interval between initiation of a manual ring call and the call being released by the calling party.

3.3.1.2.2.10.1.4 Immediate Dialing (Type 7) - The switching and control functions shall be capable of transmitting and receiving standard dial addressing as described in the VSCS-Trunks IRD and ICD.

3.3.1.2.2.10.2 Trunk Groups - At the initiation of a G/G IP call, the VTABS shall have the capability to automatically select an available trunk from a group of trunks. This capability shall not eliminate the use of dedicated IP trunks.

3.3.1.2.2.10.3 Trunk-In-Use Indications - For any IP trunk circuit accessible by more than one operational position, the VTABS shall provide a continuous visual indication of circuit-in-use to the other operational position(s) having access to that circuit for the duration of the call. The visual indicator shall distinguish between the call placed (but not yet answered) and the call in progress (call answered) states. Further, the trunk-in-use indicators provided to non-participants shall be distinct from the visual indicators (call placed, call in progress) provided for the call participants. The trunk-in-use indicator shall be provided for all trunks for which the trunk interface supports this capability (e.g. type 7).

3.3.1.2.2.11 Reserved

3.3.1.2.2.12 VTABS Numbering Plan - A comprehensive numbering plan for the VTABS, identical to VSCS, shall include the following features:

a. Access to all operational positions at any facility.

b. Minimum-length number sequence adequate for proposed facility sizing.

c. Abbreviated "dialing" for frequently used PSTN, FTS, and inter-facility calls.

d. Access to IA control functions.

e. Access to functions specified under requirements for supervisory positions.

f. Following a logical plan that will lend itself to ease of use. For example, the dial code for a position could include the ATC sector number as part of that code.

g. Compatibility with numbering plans of switching systems that interface with the VTABS (e.g., ICSS, VSCS, WECO 300/301, etc.). Number aliases, translation, or other methods are acceptable in meeting this requirement.

h. Automatic redirecting of calls initially directed to a currently unmapped or unassigned ATC sector position to a predetermined currently mapped ATC sector position.

3.3.1.2.2.13 Call Pickup - The VTABS shall provide the capability for a position operator to answer incoming IP calls from appropriate trunks, which are directed to another position. The position operator shall be able to answer from either a DA or from the IA keypad at the operator's own position in order to terminate ringing at the called position.

3.3.1.3 Other Operational Position Requirements

3.3.1.3.1 ATC Position Functions

3.3.1.3.1.1 IA Special Functions - For functions at an operational position for which it is not practical nor desirable to maintain continuous direct operator accessibility to the function, the VTABS shall provide IA entry sequences to effect the desired functions in accordance with the VTABS numbering plan. The use of IA special functions other than enable/disable position split functionality mode at an operational position shall not affect any A/G or G/G communications that may be in progress at the position.

3.3.1.3.1.2 Display Interchange - For interactive display designs using two displays with identical technologies, the VTABS shall provide an IA special function to enable the position operator at an operational position to cause the interactive display features on either display to be exchanged with those on the other display.

3.3.1.3.1.3 Inactive Position - An operational position within a given configuration shall be considered inactive for input when no voice input devices (i.e., headset or handset) are plugged into the VTABS jack module. Where no conflict exists with the control of multiple-position requirements, the interactive display, the IA keypad, PTT switches, and all other VTABS input devices shall be functionally inoperative at an inactive operational position.

With the exception of display brightness, all interactive display selections or parameters which can be controlled by the position operator shall remain set at the values last selected and in place at the time the position became inactive. The interactive displays at an inactive position shall continue to display visual status of on-going communications (e.g., squelch break, PTT confirmation, incoming calls, trunks-in-use, calls forwarded) and position selections (e.g., call routing, frequencies selected for use, BUEC selections) in a manner which is identical to that used when the position is active. Incoming A/G and G/G calls directed to an inactive position shall be automatically routed to the position's A/G and G/G loudspeakers, respectively. When a position with the voice-monitoring function and/or the radio transfer function enabled becomes inactive, these functions shall be disabled.

3.3.1.3.1.3.1 Display Brightness for Inactive Position - When a position becomes inactive, Interactive Display Unit (IDU) display brightness shall dim to the lowest readable level relative to facility lighting levels. When a voice input device is plugged into a previously inactive position, the brightness level for each display shall return to the last brightness level selected for the display before the position became inactive.

3.3.1.3.1.4 A/G and G/G Screen Toggling - Where two pages of A/G frequencies are assigned to a position, the operator shall be able to toggle from one page to the other with a single touch action. Where two pages of DAs are assigned to a position, the operator shall be able to toggle from one page of DAs to the other with a single touch action.

3.3.1.3.1.5 Status of IA Initiated Events - Status of calls and VTABS functions shall be displayed continually to the position operator. In particular, status of calls or functions initiated via IA shall be continuously visible, until no longer applicable, regardless of subsequent IA actions. Status of IA initiated calls or functions shall be depicted on the originator's Video Display Module (VDM), rather than IA keypad display, if subsequent IA entries are possible for the duration of time the status remains valid. Examples of such conditions include an IA call placed on hold and an IA initiated monitoring session.

When a call for which the originator has a corresponding latching DA is requested via IA, call status to the originator shall be provided on the VDM in a manner that is consistent with that provided when the request is originated via the DA. Similarly, when a VTABS function for which a function key is provided on the VDM is initiated via IA, feedback to the originator shall be provided on the VDM in a manner consistent with that provided when the function is selected via the VDM.

3.3.1.3.1.6 Out-of-Service Indications - A position assigned a resource such as a radio frequency or trunk that is out-of-service (i.e., unavailable for operational use) shall be provided a visual indication on the corresponding video display module following each attempt to access the resource for the duration the resource is unavailable.

3.3.1.3.1.7 Position Split Functionality Mode - The VTABS shall provide the capability to divide a position's voice communications such that one dual jack module is dedicated to all A/G communications and the other dual jack module is dedicated to all G/G communications. While in position split functionality mode, a position operator plugged into the A/G dedicated dual jack module shall have the capability to independently access A/G communications, and a position operator plugged into the dedicated G/G dual jack module shall have the capability to independently access G/G communications, on a non-interfering basis. There shall be no interaction between the dual jack modules while in position split functionality mode. Normal jack preemption and sidetone shall apply within a dual jack module.

3.3.1.3.1.7.1 Position Split Functionality Mode A/G Communications

3.3.1.3.1.7.1.1 General Split Mode Requirements - While in position split functionality mode, the position operator plugged into the A/G dual jack module shall be provided at a minimum, with the A/G communications functions identified in paragraph 3.3.1.1; with the exception that the requirement in paragraph 3.3.1.1 to provide the capability to enable and disable automatic transfer of A/G voice from HS to LS if the operator engages in G/G voice communications, shall be disabled when a position operator enables position split functionality mode. At a minimum, VTABS shall also provide the capability of recording of A/G position relief briefing, as a special A/G feature while in position split functionality mode as described in 3.3.1.3.1.7.2.1.1.

3.3.1.3.1.7.2 Position Split Functionality Mode G/G Communications

3.3.1.3.1.7.2.1 General Split Mode Requirements - While in position split functionality mode, the position operator plugged into the G/G dual jack module shall be provided at a minimum, with the G/G call types, call modes, and call features identified in 3.3.1.2 with the exception of position relief briefing which will be modified to separately provide A/G and G/G position relief briefing. At a minimum, while in position split functionality mode, VTABS shall also provide the capability for A/G monitoring by the G/G dual jack module, and shall also provide the capability of recording a G/G position relief briefing as a special feature, while in position split functionality mode, as described in 3.3.1.3.1.7.2.1.2.

3.3.1.3.1.7.2.1.1 Position Split Functionality Mode A/G Position Relief Briefing - The VTABS shall provide for the recording of A/G position relief briefing between the position operator going off duty at the A/G dual jack module and the operator assuming duties at that A/G dual jack module. While the position relief briefing recording function is active, all transmit and receive audio of the two operators plugged into the A/G dual jack module at the position shall be recorded in accordance with the VSCS-REC IRD. Activation of the A/G position relief briefing shall in no way interfere with incoming or outgoing A/G transmissions at the A/G dual jack module. During A/G position relief briefing, audio sidetone shall be provided to both jacks at the A/G dual jack module. The prerequisite for activation of A/G position relief briefing recording at the A/G dual jack module shall be two (2) headsets/ handsets plugged into the A/G dual jack module. The position relief briefing shall then be activated by a single touch action by a position operator. A continuous visual indication shall be provided for the duration of the A/G position relief briefing. A/G position relief briefing recording shall be deactivated by a single touch action by a position operator or by the removal of one headset/handset from the A/G dual jack module.

3.3.1.3.1.7.2.1.2 Position Split Functionality Mode G/G Position Relief Briefing - The VTABS shall provide for the recording of G/G position relief briefing between the position operator going off duty at the G/G dual jack module and the operator assuming duties at that G/G dual jack module. While the position relief briefing recording function is active, all conversation between the two operators plugged into the G/G dual jack module at the position shall be recorded in accordance with the VSCS-REC IRD. Activation of the G/G position relief briefing shall in no way interfere with incoming or outgoing G/G transmissions at the G/G dual jack module. During G/G position relief briefing, audio sidetone shall be provided to both jacks at the G/G dual jack module. The prerequisite for activation of G/G position relief briefing recording at the G/G dual jack module shall be two (2) headsets/ handsets plugged into the G/G dual jack module. The position relief briefing shall then be activated by a single touch action by a position operator. A continuous visual indication shall be provided for the duration of the G/G position relief briefing. G/G position relief briefing recording shall be deactivated by a single touch action by a position operator or by the removal of one headset/handset from the G/G dual jack module.

3.3.1.3.1.7.2.1.3 Position Split Functionality Mode A/G Monitoring -The VTABS shall provide the capability for the position operator at the G/G dual jack module to monitor all A/G communications emanating from or directed to the headset plugged into the A/G dual jack module. Access to A/G monitoring shall be automatically established when position split functionality mode is enabled. The position operator shall have the capability to disable and enable the function by a single touch action. A/G monitoring shall be suspended when the position operator initiates or answers a G/G call. A/G monitoring shall be automatically suspended, classmark permitting, while a monitoring position is overridden or if A/G monitoring is initiated while a position is overridden. A/G monitoring shall be automatically resumed upon termination of the communication that caused the suspension. Continuous notification shall be provided at the position of active, suspended, and inactive A/G monitoring.

3.3.1.3.1.7.3 Position Split Functionality Mode Activation/Deactivation -Position split functionality mode shall be available at a position which has both A/G and G/G communications assigned. The prerequisite for activation of position split functionality mode at a position shall be at least one headset/handset plugged into the A/G dual jack module and at least one headset/handset plugged into the G/G dual jack module. Position split functionality mode shall be activated by either one touch action to the valid key when on appropriate VDM page by either position operator, or by entering an IA keypad special function. A continuous visual indication shall be provided at the position for the duration of the activation of position split functionality mode. Position split functionality mode shall be disabled by the following methods:

a. one touch action to the valid key on the appropriate VDM page by either position operator

b. removal of all headsets/handsets from one dual jack module by either position operator (if two controllers are plugged into one of the dual jack modules, both must unplug to disable split functionality mode)

c. LTP reconfigurations, or logical reconfiguration for positions whose A/G or G/G classmarks are being removed. VTABS shall not disable position split functionality mode at positions which are logically reconfigured but which retain classmarks for both A/G and G/G communications. The disabling of position split functionality mode shall not precede the implementation of the execution stage of the reconfiguration.

d. Entering an IA keypad special function.

When enabling or disabling split functionality mode, at a minimum, all incoming communications will be retained. Notification shall be provided to the supervisor when position split functionality mode is enabled or disabled.

3.3.1.3.1.8 VTABS Operational Position Entry And Display Function Requirements

3.3.1.3.1.8.1 Communications Access - The VTABS position entry/display function shall provide for user access to A/G and G/G communications, and to all user control processing and entry/display implementation.

3.3.1.3.1.8.2 Human Interface - The entry/display function shall provide the human interface to the VTABS. The VTABS human interface is defined to be all displays, data entry devices, command entry devices, and voice transducer devices and their controls with which an operator accesses or uses the services of the VTABS.

3.3.1.3.1.8.2.1 Operational Position Human Interface - The VTABS operational position entry/display function shall consist of all hardware, software, and firmware that comprise or directly support the VTABS human interface. Each VTABS position electronics module (PEM) shall provide an interface to the following VSCS position entry/display devices:

Device	Quantity
Video Display Module (VDM)	2
VSCS IA Keypad (VIK)	1
Footswitch	1
Dual Jack Module with Volume Control	2
A/G Loudspeaker with Volume Control	1
G/G Loudspeaker with Volume Control	1

3.3.1.3.1.8.2.1.1 Headsets/Handsets and PTT Switches - The VTABS PEM shall be capable of interfacing to the VSCS dual jack modules in the position console. The PEM analog interface to headsets/handsets and hand-held PTT switches shall be compatible with existing ARTCC equipment.

3.3.1.3.1.8.2.1.1.1 Jack Preemption - A PTT action by a position operator plugged into either preempting jack shall cause the termination of any transmission in progress by a position operator plugged into either preemptable jack. The preempted position operator shall be provided the preempting voice, but shall not receive sidetone of his own voice for the duration of the preemption.

3.3.1.3.1.8.2.1.2 Loudspeakers - The VTABS PEM shall provide an interface to two identical loudspeakers (LSs) provided in the VSCS position consoles. One LS shall provide A/G communications when selected, the other G/G communications when selected.

3.3.1.3.1.8.2.1.3 LS Volume Control - The VTABS PEM shall provide an interface for the volume control interface for each loudspeaker.

3.3.1.3.1.8.2.1.4 Foot Switch - The VTABS PEM shall provide an interface for the VSCS foot activated PTT switch provided in the position console.

3.3.1.3.1.8.2.1.5 Video Display Module - The VTABS PEM shall provide an interface to the two VDMs installed in each position console. The VTABS PEM shall support all entry/display functions required for A/G and G/G functions, and shall provide the air traffic controller position with the same control supported by VSCS. Controls shall include, but not be limited to, the following.

3.3.1.3.1.8.2.1.5.1 Display Selection - Where two entry/display devices using identical technologies are provided at a common console, the VTABS PEM entry/display function shall provide the position operator the capability to selectively alternate the two communications displays and functions between the two devices. The alternate selection shall be activated by entering an IA control code. Activation of the alternate display command shall cause the entry/display interactive control functions and images on one device to interchange with those on the other.

3.3.1.3.1.8.2.1.5.2 Display Brightness - The VTABS PEM shall provide the capability to control the brightness of any operational position's video display module. The brightness shall be adjustable across its range of brightness, with a minimum of 20 discrete steps, where the brightness ratio between any two adjacent steps is a constant, or continuously along an exponential curve connecting such discrete points. The minimum brightness setting shall be no brighter than that needed to maintain readability of the display under normal facility lighting conditions.

3.3.1.3.1.8.3 Feedback to Operators - The VTABS shall provide positive feedback for all A/G, G/G, or position functions initiated by an position operator. Where visual or audible indications are not otherwise specified, the operator shall be provided messages, color changes, shape changes, brightness or intensity level changes, or other distinct indications confirming a requested system action, or indications that the action was not performed.

3.3.1.3.1.8.3.1 VDM Touch Entry Action Feedback to Operator - The VTABS shall provide visual feedback to the position operator of valid touch detection by the VDM touch entry device (TED), and an invalid touch shall be provided for touches to touched areas where no VTABS function or feature is invoked on the VDM display. The VTABS shall provide an operator-selectable (on/off) keyclick, indicating valid touch, and shall be provided a keyclick tone to the position operator's HS. Keyclick provided at a position shall not be transmitted over any A/G or G/G communications emanating from the position.

3.3.1.3.1.8.3.2 VSCS-to-VTABS Switchover Notification -The VTABS shall provide each operational position configured with a VTABS PEM a message indicating the VTABS has been activated for primary A/G and G/G communications at the position. The message shall be displayed on both position VDMs following switchover to the VTABS from the VSCS. The message shall not be cleared until acknowledged by the position operator.

3.3.1.3.1.8.4 Function Timeouts - Where timeouts have been required in this specification, and for any other interactive operational sequences requiring two or more touch actions by a position operator to complete, then a timeout process shall be invoked after a system-level programmable time interval appropriate to the operational sequence (not greater than 60 seconds), if the operational sequence is not completed. The position operator shall be notified that such a timeout has occurred. In general, the timeout process shall effect a cancellation of the operational sequence.

3.3.1.3.1.8.5 Tone Volume Control - The volume for all audible feedback tones, except externally supplied tones, shall be adjustable by the position operator. Volume levels shall be identical to VSCS.

3.3.1.3.1.9 Chimes - The VTABS PEM shall provide chime device for each operational position to alert the operator to incoming G/G communications. The chime device shall be capable of generating five distinct chime tones. The device tones shall be selectable for a given physical console position by the data entry operator function through site adaptation data, and download to the position in the position maps. The position operator shall not be allowed the capability of changing the tone. The chime device audio shall be available to the position operator through the position G/G loudspeaker.

3.3.1.3.1.9.1 Chime Volume - The VTABS PEM shall provide the chime control interfaces to support the on/off switch, volume control, and a visual on/off status indicator provided on the VSCS G/G loudspeaker. The chime volume control and the LS volume control shall be coupled in such a way that the chime volume remains discernibly below the LS volume when the LS volume control is adjusted up or down. Adjustments to the chime volume control shall not couple to the LS and shall permit adjustment of the chime volume lower than LS volume.

3.3.1.3.1.10 VIK - The VTABS PEM shall provide an interface for the VSCS IA Keypad provide in the position console. The VIK function shall support initiation of IA calls and IA special functions.

3.3.1.3.1.11 Voice (Legal) Recording - The VTABS PEM shall provide and interface to the Government Furnished Equipment (GFE) legal voice recording system as specified in the VSCS-REC IRD. Two recorder channels shall be provided at each position at all times. The first recorder channel shall record all voice signals (i.e., all A/G communications and G/G communications including the position briefing) on all circuits entering and leaving each position. The second channel shall record all incoming and outgoing A/G communications at the position. The legal recorder channels for each position shall be routed directly to the legal recorder interface. The combining point shall be prior to any Volume Controls and the output shall be - 10 dBm with a nominal Test Tone into an interface point on the Jack Module.

Upon activation of position split functionality mode operations, one recorder channel shall separately record voice signals of the dual jack module dedicated to G/G communications, and the other recorder shall record voice signals of the dual jack module dedicated to A/G communications.

3.4 VTABS TRAINING SUBSYSTEM FUNCTIONAL REQUIREMENTS

3.4.1 Training Subsystem Features

The VTABS Training subsystem provides the student with the interactive capabilities of the VSCS VCE display and provides simulated Air-to-Ground (A/G) and Ground-to-Ground (G/G) voice paths, call types and call features for Instructors and Pilot positions.

The Training subsystem hardware will not be configured to support BUEC or all existing radio types; only Grim Radio interfaces shall be provided to support frequency loopback. In addition, Training subsystem G/G equipment will not be configured with the hardware to support all VSCS trunk types. Only types 3 (Tone Burst), 5,7, and 9, shall be supported.

The Training subsystem shall not support the BUEC and cross-coupling features of the VSCS.

3.4.1.1 VTABS Training Subsystem Configuration - The VTABS Training subsystem hardware configuration shall support the following: Student positions; Pilot positions; Instructor position analog phone sets; a Master Instructor position; A/G Radio interface loopbacks; and G/G Trunk interface loopbacks.

3.4.1.1.1 Student Position - The Student Position shall consist of a PEM which is interfaced to GFE VSCS console equipment peripherals.

3.4.1.1.2 Pilot Position - The Pilot Position shall consist of a PEM chassis which is interfaced to GFE VCE that simulates voice communications of either an aircraft or another ATC position. The communications requirements are identical to those of the student position. Although the Pilot position hardware and connectivity are the same as the Student position, Pilot positions may use different configuration maps and classmarks in order to meet the communication requirements of the training scenario.

3.4.1.1.3 Instructor Position - The instructor position shares the same VCE peripheral equipment as the Student. The instructor's capability shall be provided by using the second (preempting) dual jack module (DJM) at each student position. Using the second DJM, the instructor can monitor the students simulated A/G and G/G communications with the Pilot positions. A PTT action by the instructor at the preempting jack shall cause the termination of any transmission in progress by the student plugged into the preemptable jack and shall cause the instructors microphone to be active. By sharing the student's VCE peripherals, the instructor position has the same communication capability as the associated student position, except for PTT preempt noted above.

In addition, the instructor position shall contain an Analog Telephone set connected to a 2 wire trunk circuit. This trunk shall be configured as a Type 8 IP circuit, which is nonselective ringing outbound to the instructor, and dial selective inbound from the instructor. The Analog Telephone set shall provide the instructor the capability to receive calls from any position and to place calls to any position in the Training subsystems configuration. Activation of an Analog Telephone call by the instructor position shall not interfere with the student communications. The Analog Telephone set communications capability shall be controlled by the Training subsystem configuration maps. The analog phone sets shall be mounted at or near the Student Data position writing shelf.

3.4.1.1.4 Master Instructor Position - The Master Instructor Position shall be comprised of a PEM chassis interfaced to GFE VCE peripherals; GFE cassette voice recorders; a workstation for execution status, monitor, and control functions; and a printer interface. The Master Instructor's position equipment shall provide the Master Instructor with full system monitoring capability, and A/G and G/G communication functionality. The Master Instructor position shall be capable of being assigned A/G and G/G communication functionality through classmarking and configuration maps.

The VTABS Training subsystem shall provide the Master Instructor workstation combined data entry, reconfiguration and position configuration status, and system status monitor and control capability (combined DEO, Maintainer, and Supervisor functionality). The Master Instructor position workstation shall provide system monitoring, maintenance, map generation, reconfiguration control, and voice recorder allocation functions. The Master Instructor position shall include a line printer for printing hardcopy reports.

In addition, the Master Instructor shall be provided the capability to configure the Training subsystem for single and multiple sector operation to support training scenarios. The Master Instructor capabilities shall be controlled by user logon and classmarks, and shall be limited to the Training subsystem only.

3.4.1.1.4.1 Master Instructor Voice Recording - The VTABS shall provide the capability for position voice recording. The VTABS Training subsystem switching equipment shall provide an interface to the Master Instructor position GFE cassette recorders via a 600 ohm analog line interface. The recording and playback device or devices shall accommodate commercially available cassettes that are capable of at least 60 minutes of recording time. The recording device shall have a voice-operated switch (VOX) recording capability.

The Training subsystem Master Instructor Position shall have the capability of selecting any position in the Training subsystem configuration for recording. Each monitoring connection established shall be capable of being recorded. The VTABS shall provide a cassette recording and playback device or devices capable of simultaneously recording the monitored communications of up to twenty four (24) positions in the Training subsystem configuration. Each recorded position's communications shall be recorded on a separate cassette.

3.4.1.1.5 Training Subsystem G/G Interphone Circuits - The VTABS Training subsystem shall provide Interphone trunk pairs. Each trunk pair represents both ends of an inter-facility trunk. One end represents the student's facility and the other end is the simulated facility of the Pilot Position. The VTABS Training subsystem switching equipment shall be configured with SF/VOX II interface cards for each trunk pair.

The Training system shall provide all trunk types that are supported by the SF/VOX II interface card that can be configured into a symmetrical loopback. (The loopback avoids the need to interface with like radios for training purposes). This shall include, but not limited to, Type 3 Manual and Auto Ring, Type 5 selective signaling, Type 9 voice calls, and Type 7 circuits. Because each of these trunk types are supported by the SF/VOX II card, each pair shall be reconfigurable via configuration site adaptation data changes to any of the other trunk types supported.

3.4.1.1.6 Training Subsystem A/G Interfaces - The VTABS Training subsystem shall provide A/G radio frequencies pairs. One card of the pair shall simulate the frequency at the Student's position. The other card of the pair shall simulate the frequency at the Pilot's aircraft. The two cards shall be cross-connected in such a way that transmission from one card causes a squelch break at the other card. The VTABS shall support mapping from one Student to multiple simulated aircraft or one aircraft to multiple Students.

The VTABS Training subsystem shall be capable of configuring each GRIM radio interface card to operate in either Split or Selective mode. Each loopback pair in the training configuration shall be a fixed configuration, and shall be reconfigurable from split to selective or selective to split mode via configuration site adaptation data changes.

3.4.1.1.7 Training Subsystem Interfaces - The Training system provides communication capability between Student Positions, Instructor Positions, Pilot Positions, and a Master Instructor Position. The VTABS Training subsystem shall be implemented as a closed system with no connectivity to the VTABS Backup subsystem, or to the VSCS, A/G frequencies, or G/G trunk resources.

3.4.2 Training Subsystem Position Training Features

3.4.2.1 Pilot Position, Frequency, and Trunk Aliases - The VTABS shall provide the capability for two or more positions to display identical frequency values or DA labels for different physical frequency and trunk resources. In other words, frequency value and DA label "aliases" can be displayed on the Training system displays. This capability provides the maximum flexibility for supporting various training scenarios, allowing multiple positions to have identical communication assignments on a non-interfering basis. The VTABS Training subsystem shall provide the capability to assign identical A/G and G/G assignments (including the same labels), to multiple positions in order to exercise certain functionality such as PTT preempt, PTT lockout, and Trunk-in-Use indications.

Each Student, Pilot, and Instructor position in the Training subsystem shall have a unique IA dial code. These dial codes shall be set to be compatible with individual facility dial codes/numbering plans and shall be changed through reconfiguration. All training positions shall have the capability to access any other training position (by dialing the appropriate dial code).

3.4.3 Training Subsystem Instructor Position Training Features

3.4.3.1 A/G Communication - The Instructor Position's A/G communication capability shall be provided by using the second (preempting) DJM at each student position. When the Instructor is plugged into the Student VCE, all A/G communication functions that are available to the Student shall be available to the Instructor position.

3.4.3.2 G/G Communication - The Instructor Position's G/G communication capability shall be provided by using the second Dual Jack Module (DJM) at each student position. When the Instructor is plugged into the Student VCE, all G/G communication functions that are available to the Student shall be available to the Instructor position.

In addition, the Instructor position shall be provided G/G IC communications via an analog phone set. This shall provide the Instructor with G/G IC communications that are independent from the Student position. The Instructor shall have the capability to selectively dial any Student or Pilot in the Training subsystem configuration facility by entering the position's two (2) digit IP dial code.

3.4.4 VTABS Training Subsystem Theory of Operations

The VTABS training configuration contains positions referred to as ATC positions and Pilot positions. The Pilot positions, along with acting the part of airplane pilots, pilots, play the role of several ground based ATC positions during training scenarios. This capability exists in order to simulate hand-offs or briefings between different air traffic controllers and the student ATC position. The pilot performing G/G simulation will, most often, be acting as several positions since it is impractical to have a pilot position for every air traffic controller that the student must talk to as part of controlling his/her sector.

To support this required functionality, the training software will not determine the calling party ID based entirely on the primary function/extension of the calling position. Instead, the data entry position will edit the DA button definition to add an "alias". This alias permits a particular calling party function/extension to be attached to the DA instead of using the default primary function/extension. When a DA of this type is used, it originates a call as if the alias function/extension was originating the call. Using this method, the pilot can have DA buttons corresponding to every air traffic controller she/he needs to simulate during a training scenario.

For incoming calls, the Training subsystem software will seek out a destination DA with both matching "alias" and destination. In addition to the enhanced DA search algorithm, the Common Answer (CA) queue labels for all positions will be modified to contain both the calling and called party IDs. This is so that if the pilot does not have a DA to match an incoming caller, she/he can still tell who the called party ID is.

3.5 VTABS STATUS MONITOR AND CONTROL FUNCTION

The VTABS status monitor and controls functions shall be provided by the VTABS control subsystem. All status, monitor and control, reconfiguration , system startup, and data entry functions shall be controlled by the control subsystem. The control subsystem shall provide an independent workstation, to provide configuration and control of the control subsystem hardware and software. The VTABS shall provide independent control subsystems for the Training subsystem and Backup subsystem. The Training and Backup subsystem's control subsystems shall have no shared hardware or software interfaces, and shall be capable of performing all system functions independent of each other. Each control subsystem shall provide mass storage media and a printer interface for printing reports and data files.

3.5.1 VTABS Data Entry Function

3.5.1.1 VTABS Data Entry Position - The VTABS shall provide data entry operator functions for both the Training and Backup subsystems. The data entry function shall provide the capability to access the VTABS configuration database and system communication status data. Access to the data entry functions shall be provided via any workstation and controlled via user logon, password, and classmarks. The DEO position operator shall be capable of defining and configuring the communications capabilities and classmarks provided by the VTABS workstations, positions, and switching equipment. DEO access to the VTABS database shall not perturb or impede the real-time data and communications processing requirements of the VTABS Training or Backup subsystems.

3.5.1.2 Data Entry Position Equipment - The data entry position shall be provided with a workstation, a local hardcopy printer device, interface to a high speed printer for printing reports, and interface to mass storage media.

3.5.1.3 VTABS Map Generation - VTABS Training and Backup subsystem features and functions associated with each position are assigned by maps which contain site configuration data (e.g. frequencies to be used for A/G and number/types of trunks). The maps also contain classmarks which define each positions capabilities and limitations.

The DEO function for the VTABS Training and Backup subsystems shall have the capability to create new configuration maps and edit existing configuration maps.

3.5.1.4 VTABS Configuration Maps - The VTABS configuration maps shall have the following characteristics:

a. The VTABS system configuration maps are not hierarchical - the VTABS maps shall be built as a pool of position maps. The Logical/LTP maps shall define how these position maps get placed on positions.

b. VTABS system configuration maps shall allow duplicate A/G and G/G resource labels to be defined. This capability shall only be available in the Training subsystem.

c. The VTABS system shall not impose sector position coverage constraints. Definition of all logical positions required for a sector shall not be required.

The DEO shall have the capability to enter and edit Site Adaptation Data (SAD), create maps, edit/update maps, and perform manual map validation. A brief description of these capabilities is outlined in the following paragraphs:

d. SAD - The DEO is responsible for entering Site Adaptation Data into the database which includes establishing the hardware configuration, physical resources, and logical resources. Once the SAD is established it is used as a pool of resources for the Configuration Map Build process.

e. Map Creation - The DEO is responsible for creating/adding Configuration Maps defining the functional capabilities, communication assignments, and classmarks for A/G and G/G communications for each operational position within the facility.

f. Map Editing/Update - The DEO is responsible for editing existing maps off-line to provide maps which reflect different training scenario requirements.

g. Map validation - All DEO inputs are verified and validated against a defined set of resource definitions both during and after map modification or creation.

3.5.1.4.1 Database Size - The configuration database shall be capable of containing all position configurations necessary to support the operational requirements for routine reconfigurations within a facility's Training or Backup subsystem. The capability shall be provided to define, at a minimum, five (5) position maps per position in the configuration database. Storage shall be sufficient to maintain the configuration database, backups of the configuration database, and maps and databases under development in support of resectorization.

3.5.1.5 VTABS Training Subsystem Special Operations for Simultaneous Sectors - Multiple Training subsystem positions shall be allowed to have identical configuration maps. This feature shall be prohibited in the Backup subsystem by classmark control. The Training subsystem shall have the capability to define two or more identical positions (or sectors or areas) in order to support the training and familiarization requirements. In this scheme, sectors shall be numbered 01 through 99. The "shadow" sectors shall be numbered 101-199. Thus, the radar position in sector 48 (R-48) is configured identically to the radar position in sector 148 (R-148) and likewise for the data positions (D-48 and D-148). The Training subsystem approach extends this concept further, as required, such as sectors 248, 348, 448 and so on. This allows up to ten simultaneous "copies" of a single configuration. This capability shall preserve the integrity of the Training subsystem numbering plan. That is, the first digit dialed shall designate the type of position (e.g., 1 = radar, 2 = data) and the subsequent three digits shall designate the sector being called (048 or 148, for example).

While all the frequencies and DAs at these duplicate positions may be labeled identically, the switch terminations shall not be the same. For example, when position R-48 PTTs frequency 123.3, squelch break will be indicated at, and voice routed to, pilot position "a." However, when position R-148 PTTs frequency 123.3, squelch break is indicated at, and voice routed to, pilot position "B." Ensuring that the voice connectivity is properly established, and the accompanying indications are present, is a function of the configuration map(s).

3.5.2 Reconfiguration Control Function - The VTABS shall provide the capability to control the configuration of the Training and Backup subsystem position communications functions through a reconfiguration function. Reconfiguration control shall be provided via the position workstations. Access to the VTABS reconfiguration function shall be controlled by user logon, password, and classmarks. In the Training subsystem, the Master Instructor workstation shall be provided the capability to perform reconfigurations of any position in the Training subsystem configuration. In the Backup subsystem, the supervisory positions shall have the capability to perform reconfigurations of any position in the Backup subsystem configuration.

In either subsystem, positions classmarked with reconfiguration capability shall have the ability to download maps to the position and switching equipment. The configuration of both subsystems shall be controlled by its respective control subsystem's reconfiguration function. Reconfigurations executed on the Training subsystem shall not impact the configuration of the Backup subsystem or vice versa.

3.5.2.1 Levels of Reconfiguration - The following paragraphs describe the reconfiguration capabilities provided by the VTABS:

a. LTP Reconfiguration - The VTABS shall provide two types of LTP reconfigurations. First, storage of Logical/LTP maps shall be provided to allow switching between position configurations. Second, a capability to perform single assigns, de-assigns, and moves shall be provided.

b. Combined Logical-LTP reconfigurations - This function shall be accomplished through invoking a pre-defined Logical/LTP map.

c. Concurrent Reconfigurations - The VTABS system shall perform concurrent reconfigurations for non-overlapping logical and LTP reconfigurations. Reconfigurations can be requested from multiple workstations concurrently but all overlapping reconfigurations shall be initiated on a first-come first-served basis.

d. Two Step Reconfiguration - All reconfigurations in the VTABS system shall be two step reconfigurations similar to VSCS. Continuation of the reconfiguration shall take place from the Master Instructor position or the Supervisory position initiating the reconfiguration.

e. Temporary Modification - The VTABS shall provide the capability to download "temporary modifications" to any position's active map. It shall allow A/G, G/G and Classmark resources of positions to be altered as part of the temporary reconfiguration. The VTABS shall allow the temporary map to be saved as a permanent map if desired.

3.5.2.2 Reconfiguration Initiated by Maintenance and NAS Manager Positions - The VTABS Backup subsystem shall provide the maintenance and NAS Manager positions the capability to initiate position-level reconfiguration, as classmarked, for their respective VTABS position equipment. The available options shall be displayed to the maintenance and NAS Manager position workstations. The capability shall be provided for selection of the desired reconfiguration.

3.5.2.3 Unmapped Console Functional Settings for Reconfiguration - This section provides for the functional settings for physical consoles that have gone to an unmapped state (e.g., previously assigned logical position which is combined/rolled into another position, or one that is eliminated in a LTP reconfiguration). The default settings for an unmapped console shall be:

Page Display	Utility Screen
G/G Voice Routing	LS for OVR, LS for Non-OVR
Keyclick	OFF
Auto Xfer	ON
R/T function	OFF
Tone Volume	Medium (applies to all volumes set via the interactive displays)
HS/LS Volume	Previously selected level
Chime State and Volume	Previously selected state and level
Display Brightness Setting	Previously selected level

3.5.2.4 A/G System States for Reconfiguration - For any reconfiguration, BUEC, main/standby selection, and remote mute for each frequency shall remain in the current system state. Reconfiguration of a position with the capability to select a frequency site for site group maintenance shall remove the frequency site(s) from site group maintenance. A frequency site(s) shall display the site group maintenance status after a reconfiguration.

3.5.2.5 Call Forwarding Limits for Reconfiguration - Call forwarding between positions shall remain intact (i.e., between the original logical positions) under a logical-to-physical (LTP) reconfiguration in which the logical source and/or the logical destination are moved physically. Additionally, call forwarding shall remain intact if the destination position is logically reconfigured. Reconfigurations which alter the source position's logical identity need not retain call forwarding.

3.5.2.6 Voice Monitoring Limits for Reconfiguration - Voice monitoring between positions shall remain intact (i.e., between the original logical positions) under a logical to physical (LTP) reconfiguration in which the logical source and/or the logical destination are moved physically. Additionally, voice monitoring shall remain intact if the monitored position is logically reconfigured. Reconfigurations which alter the monitoring position's logical identity need not retain voice monitoring.

3.5.2.7 Position Split Functionality Limits for Reconfiguration - The VTABS shall disable the position split functionality mode at positions which undergo an LTP reconfiguration. VTABS shall not disable position split functionality mode at positions which undergo a logical reconfiguration unless the reconfiguration removes the classmark for either A/G or G/G communications. When a reconfiguration disables split functionality mode, the disabling of position split functionality mode shall not precede the implementation of the execution stage of the reconfiguration. It is not the intent of reconfiguration to disable position split functionality mode for positions whose position map is not changing. Reconfiguration of a position with position split functionality mode enabled shall not disrupt calls in progress at either the A/G dual jack module or the G/G dual jack module.

3.5.2.8 Display of Position Status - The VTABS shall provide a display of In-Service (IS) and Out-of-Service (OOS) Mode Transitions. Except for Facility Size modifications, a position which is OOS shall not be reconfigured. An indication shall be provided at the initiating workstation indicating the reconfiguration can not be performed due to the PEM being out-of-service.

3.5.3 Additional VTABS Supervisory Functions

3.5.3.1 Reserved

3.5.4 VTABS Maintenance and NAS Manager Position Functional Requirements

3.5.4.1 Local Maintenance and NAS Manager Positions - The VTABS shall provide the capability for position workstations to be designated as the facility local maintenance or NAS Manager position. The maintenance and NAS Manager workstation shall have the capability to request, control, display, and store on-site test and store test results. All built-in test equipment (BITE) and built-in testing (BIT) shall be accessible from these position workstation. The maintainer and NAS Manager workstations shall be provided with a local printer interface, and shall have access to the control subsystem printer device.

Distribution frames and patch panel facilities shall be as physically close as practical to the maintenance position.

3.5.4.1.1 Local Maintenance Position Equipment - In addition to the workstation equipment defined in 3.5.4.1, the local maintenance position shall be provided access to a patch panel that provides access to all voice grade circuits. The patch panel shall provide the capability to connect digital/analog test signal generators, and other external test equipment to accomplish tests, measurements, and verifications of voice channel parameters.

The VTABS patch panel shall be provided within the VTABS interconnect subsystem for monitoring and patching IP trunks, A/G, and PABX circuits (if used) for maintenance access. The patch panel shall provide a means for monitoring all outgoing and incoming IP trunks, A/G, and PABX circuits (if used). The patch panel shall provide a means for connecting to either the line or equipment side of a circuit for test and for isolating a circuit from an external interface for testing. The patch panel shall be arranged to:

a. Allow access to IP trunk and PABX (if used) supervisory signaling lines for make busy tests.

b. Allow execution of test to establish an out-of-service condition on a A/G, IP trunk, or PABX circuit (if used).

c. Allow insertion of test equipment to inject tones, monitor, and originate outgoing or incoming calls for testing trunks.

d. Allow access to the equipment side of all A/G and G/G circuits to support test of the VTABS switching equipment.

e. Test interswitch trunks.

f. Access the line side of all circuits.

3.5.4.1.2 Local Maintenance/NAS Manager Position Features - The VTABS shall provide an event logging function to allow the maintenance position operator or NAS Manager to view system status events, and to select and print event reports.

The maintenance workstation function shall provide the capability to control the operational modes (transition to an off-line or on-line mode) of all VTABS system equipment (positions, switch subsystem equipment, control subsystem). The workstation shall provide the capability to execute diagnostic test to verify equipment functionality.

The maintenance position and/or the NAS Manager position shall be provided with a hardcopy printer device for printing reports and logs available through the workstation.

Access to the VTABS maintenance functions shall be controlled by workstation user log-on, password, and classmarks.

The maintenance workstation function shall provide the capability to minimize the manual diagnostics "Window" and shall not allow an operator to log-off if a diagnostics procedure is being performed.

3.5.4.2 Status Monitoring and Control - The monitoring of real-time system performance, the reporting of system status and failures, and the local maintenance and NAS Manager, or Master Instructor control over system resources to facilitate continuation or restoration of VTABS operational service shall be provided to support real time quality control (RTQC).

The VTABS Training subsystem and Backup subsystem shall have dedicated system monitor and control subsystems. For each VTABS subsystem, the respective system monitor and control (SMC) subsystem shall provide centralized access to the VTABS equipment status monitoring functions, the reconfiguration functions, system initialization functions, and the system administration functions.

The system monitor and control subsystem shall provide the CHI to support these supervisory and maintenance functions through dedicated workstations for supervisory and maintenance personnel.

The Training subsystem equipment status shall be provided to the maintenance and the Master Instructor Workstations. The Backup subsystem status shall be provided to the maintenance, NAS Manager, or supervisory position (Area Manager) workstations.

System status changes in either subsystem shall be sent to the associated workstation(s) as they occur. System events shall consist of operational events (logons, reconfigurations, etc..), anomalies, errors, and hardware faults. All system events shall be logged into the system event log. Such events shall include maintenance related events such as failures, recoveries, and maintenance actions. The status monitor and control subsystem shall provide the capability to print the system event log, and provide the capability to display the system event log at the workstation.

3.5.4.2.1 Operations Status Monitoring - The capability shall be provided to monitor operational functions to include, at a minimum, monitoring the operational status of A/G and G/G of all assignments within a facility. The status of these conditions shall be available for display at maintenance, supervisory, and NAS Manager workstations.

3.5.4.2.2 Performance Status Monitoring - A real-time system performance monitor shall be provided to monitor system equipment status and to report failures for dissemination to maintenance, NAS Manager and supervisory personnel, or Master Instructor for the Training subsystem.

The VTABS system shall provide Built In Test/Automatic Fault Isolation (BIT/AFI) for detection of system equipment failures. All on-line and off-line failure detection shall be accomplished using a series of background tests to detect and isolate failures in the system. Results from periodic self-tests of equipment and indication of equipment failures shall be provided. For the VTABS control shelf background tests, LRU status shall be provided when a single LRU can be identified within the shelf configuration. LRU status data provided for control shelf background test failures will be used in fault isolation of defective control shelf circuit card assemblies. Once a failure has been detected, the faulty LRU can be transitioned to an out-of-service mode to perform maintenance tasks on the equipment off-line.

3.5.4.2.3 Performance Reporting - System equipment and functional status, the detection of system and functional failures, and the recovery measures taken shall be reported to the maintenance position, NAS Manager position, supervisory positions, or Master Instructor as classmarked.

3.5.4.2.3.1 Reports to Maintenance and NAS Manager Positions - System status shall be available at a 5-second periodic rate. Status output shall be selectable. In the event of a failure, an indication identifying the failed equipment, and its relationship to the system shall be provided. Audible and visible alarms indicating the failure status shall be provided. Failures shall be categorized, prioritized, and stamped with time of detection. Where audible alarms are used a muting capability shall be provided. All critical failure alarms shall be maintained until the problem has been acknowledged by an operator, and status of the failure maintained until the problem has been resolved. Non-critical failure audible alarms shall be maintained until acknowledged or a default time-out has been reached.

The VTABS shall provide the capability to generate an event log report from the current system event log. The event log report function shall provide the capability to generate an event log report for any operator specified time period. The event log report function shall provide the capability to generate a summary event report or a detailed event report for the specified time period. The maintenance and NAS manager position operator shall be provided the capability to view all events within the specified time period at the workstation, and the capability to generate a print-out of the specified event report.

3.5.4.3 Failure Logging - All VTABS equipment failures shall be logged and stored. The capability shall be provided to format failure reports and to select output data according to, at a minimum, date and time for display and hardcopy print output.

3.5.4.3.1 Software Error Logging - In addition to BIT/AFI, the VTABS software shall provide the capability to generate and log software errors. Software errors in each computer processor subsystem shall be reported to the control subsystem. The capability to generate software error reports for display and/or hard-copy print out shall be provided.

3.5.4.4 Control - The VTABS shall be provided the capabilities required to control the recovery from system failures, the execution of diagnostics, and the output resulting from the monitoring function.

3.5.4.4.1 Failure Recovery - The maintenance and NAS Manager positions, or Master Instructor shall have the capability to initiate manual recovery procedures to maintain system performance by reconfiguring the system around the problem areas.

3.5.4.4.1.1 Functional Recovery - After position failure recovery without an intervening position-level reconfiguration of that position, the position equipment shall return to the configuration in effect prior to the failure, including any temporary changes to that configuration.

3.5.4.4.2 Diagnostic Control - The VTABS maintenance function shall provide the capability to initiate diagnostic testing for failure isolation. The maintenance position, NAS Manager positions, or Master Instructor position shall have the capability to establish any connection that can be provided to operational positions.

3.5.4.4.3 Reporting Selection Control - The maintenance and NAS Manager positions, or Master Instructor shall have the capability to select real-time status reports on tests. The status reports shall be selectable, at a minimum, by equipment types. Status shall be reported for operational and nonoperational equipment indicating, at a minimum, on-line, off-line, and malfunctioning equipment. The maintenance and NAS Manager positions, or Master Instructor shall have the capability to select hardcopy output for all selectable status reports and failure reports.

3.5.4.5 On-Line/Off-Line Diagnostics - Diagnostics for self-testing, failure detection, and isolation shall be provided in both the on-line and off-line mode. Diagnostic test results shall be monitored and, in the event of a detected failure, the failure shall be displayed at the maintenance, NAS Manager position, or Master Instructor position for appropriate corrective measures.

Diagnostics shall include the following:

a. Provide fault detection and reporting of the Dual Port Group Buffer (DPGB) CCA failures distinct from failures of the console voice LEs.

b. Allow the VTABS switch shelf to be transitioned directly to Out-of Service mode.

3.5.4.5.1 On-Line Diagnostics - Built-in automatic self-testing VTABS equipment shall be provided. Fault and failure detection and isolation shall be to the line replaceable unit (LRU) (except for batteries in the Power Subsystem). All faults, failures, and recovery attempts shall be reported with alarms to the maintenance position, NAS Manager position and supervisory positions, or Master Instructor position as classmarked. Manual self-testing initiated for position equipment and loop-back testing (See Section 6.2 for definition) shall be provided. Performance monitoring and fault and failure reporting for manual self-testing shall be as for automatic built-in self-testing.

3.5.4.5.2 Off-Line Diagnostics - The capability shall be provided to the maintenance and NAS Manager positions, or Master Instructor to initiate automatic and manual diagnostic procedures for off-line equipment. Diagnostics shall be for fault and failure isolation to the line replaceable unit (except for batteries in the Power Subsystem). Off-line equipment is that equipment which is currently not part of the operating system due to either automatic switchover to backup equipment or equipment out of service due to reconfiguration. Diagnostics test results shall be reported to the initiating position.

3.5.4.5.3 Diagnostic Interfaces - The VTABS shall provide access to diagnostic testing, fault and failure reporting, and recovery initiation.

3.5.5 System Startup

3.5.5.1 Installation Start - The VTABS shall have the capability of performing an installation start, as described in this paragraph, when it is installed for the first time. The system monitor and control function shall manage the orderly startup of the VTABS. Diagnostics shall be requested from all functional areas on system startup and reported as required. The facility configuration map identified during startup procedures shall be implemented. The configuration data base and operational programs shall be downloaded. The design goal for a VTABS startup, including power up and configuration of positions, shall be no more than 10 minutes.

The VTABS Training and Backup subsystems shall be capable of being initialized independent of each other from their respective status monitor and control subsystems. Initialization of the one subsystem shall have no operational impact on the other.

3.5.6 Timing and Synchronization - The VTABS shall provide for time-of-day reference within the control subsystem for time stamping system events.

3.5.6.1 Time of Day - The VTABS shall provide a time-of-day reference that shall be capable of maintaining year, month, day, hour, minute, and second.

3.5.6.1.1 Reserved

3.5.6.2 Reserved

3.5.7 VSCS-to-VTABS Backup Subsystem Transitions

3.5.7.1 Transition Equipment - An existing VSCS transition switch and control console shall provide switchover between the VTABS Backup subsystem and the critical VSCS communications equipment to access the G/G IP/PABX trunks, and the A/G radio audio and control (Radio Control Equipment (RCE), BUEC, and existing radio interfaces). The switchover shall be on a line-by-line basis for testing and as a whole for transferring ATC communications operations. Special interface equipment shall be provided as necessary to ensure continuing operation of the existing communications equipment as backup for VTABS operations. The transition switch shall provide for complete access to the existing VSCS communications equipment or the VTABS Backup subsystem and its interfacing equipment(s).

Transition switching of all paths of either the VTABS Backup subsystem or existing VSCS communication system shall be manually initiated from a single control console.

The Switchover function between the VTABS Backup subsystem and existing VSCS communication system shall be completed within one (1) second. Visual indication of whether the switchover was successful or unsuccessful shall be provided at the transition switch local and/or remote control console. In addition, notification of the switchover to VTABS shall be provided to each operational position.

Following transition from the VSCS to the VTABS Backup subsystem, each critical position shall have the capability to select the frequencies and trunks for communications via the VTABS GFE VCE as required to re-establish A/G and G/G communications.

3.5.7.2 VTABS Backup Subsystem Transition Equipment Requirements - In addition to the critical A/G and G/G circuits, the VTABS Backup subsystem shall provide the capability to transition critical positions' peripheral equipment from the VSCS VEMs to the VTABS Backup subsystem PEMs. The transition shall be initiated via the bulk switch function that is commanded from the VSCS Transition switch control console.

Initiation of a bulk transfer from the Transition switch control console shall result in all designated VSCS critical positions being transitioned to the VTABS equipment. The VSCS position display and entry devices shall be switched to the VTABS PEMs. Following initiation of the bulk transfer switchover from the VSCS to the VTABS, the critical ATC position's entry and display devices shall be operational within 10 seconds. Following completion of the VTABS transition, the ATC position operator shall be capable of performing the position control functions required to configure the VTABS.

Switchover from the VTABS to the VSCS shall be accomplished via the same bulk transfer operations, at the transition switch control console.

3.6 INTERFACES

3.6.1 General

This section provides a list of the external interfaces of the VTABS, which is also a directory of the pertinent Interface Requirements Documents (IRDs).

3.6.2 Reserved

3.6.3 Reserved

3.6.4 Reserved

3.6.5 Reserved

3.6.6 VTABS-BUEC

This interface shall provide an A/G voice communication path into the Backup Emergency Communication (BUEC) radio equipment. The interface between the VTABS and BUEC shall be as described in the VSCS-BUEC IRD.

3.6.7 VTABS-PABX

Reserved

3.6.8 VTABS-Trunks

VTABS interfaces to trunks shall be governed by the VSCS-Trunks IRD.

3.6.9 VTABS-REC

The Recording System (REC) provides tape recording facilities that make a legal record of all ATC voice communications. The interface between the VTABS and REC shall be as described in the VSCS-REC IRD.

3.6.10 VTABS-DSR

The interface between the VTABS and DSR Console shall be described in the VSCS-DSR IRD.

3.6.11 VTABS-Power

The VTABS shall be capable of drawing power either from FAA's critical power bus or from commercial alternating current (AC) line power according to operating environment. The power connection shall be in accordance with the VSCS-Power IRD and ICD. The VTABS power load shall meet the in-rush power factor and individual harmonic and total harmonic requirements of FAA-STD-2100F**.**

3.6.12 VTABS-Existing Radio Interfaces

The existing radio interfaces will provide interconnecting paths between the VTABS and the A/G radio transmitters and receivers. The interface between the VTABS and the existing radio interfaces shall be as described in the VSCS-Existing Radio Interfaces ICD.

3.6.13 VTABS-Transmission Equipment (Analog)

The Transmission Equipment (Analog) provides the transmission media for trunks. The interface between the VTABS and the Transmission Equipment shall be described in the VSCS-Transmission Equipment (Analog) IRD.

3.7 SYSTEM RELIABILITY AND MAINTAINABILITY REQUIREMENTS

This section defines and describes design requirements that shall be achieved and elements that shall be implemented for the VTABS RMA program.

3.7.1 Definitions

The Reliability, Maintainability, Availability (RMA) terms are defined in Appendix I and MIL-STD-721.

3.7.2 Reliability

The reliability of the VTABS shall be assessed from the mean time between failures (MTBF) of certain functions or services provided by the VTABS. The MTBF shall be computed from considerations of the failure rates of all VTABS equipment involved in providing the function or service, the interrelationship of these components, and standard computational rules of reliability theory (e.g., series, parallel, I out of j).

3.7.3 Maintainability

3.7.3.1 Maintenance Concept - The maintenance concept for the VTABS program shall be consistent with the maintenance concept for the VSCS and the maintainability requirements contained within this specification.

Maintenance support for the VTABS is guided by FAA Order 6000.30B. This order establishes a two-level concept of maintenance: site and depot. First level, site maintenance, is accomplished by AF technicians or contractor support on site where the equipment is located. Second level, depot maintenance is a responsibility of AOS-550 and the FAA Logistics Center and may be accomplished by FAA or contractor personnel at a central location. The two-level maintenance concept assumes the use of modular equipment which enables technicians to correct a majority of equipment failures on site by replacing faulty line replaceable units (LRU). LRU identification will use the Equipment Bar Code system used with the VSCS. This maintenance concept will be applied to the VTABS throughout its operational life cycle.

The VTABS shall incorporate automatic fault-isolation in the form of built-in test/built-in test equipment (BIT/BITE) and external test equipment which will provide access to the system through external test points. The VTABS shall be capable of detecting and isolating faults within the system. The system will have an on-line fault-isolation capability to one or two LRUs in 95 percent of all failures, and to one LRU in 85 percent of all failures.

The remaining failures shall be isolated using external test and support equipment. System faults shall be displayed at the NAS manager, AT Area Manager, Master Instructor, and AF maintenance positions. The VTABS shall be capable of being maintained without disruption to Air Traffic Control operations when the communication function is controlled by VSCS.

3.7.3.2 Preventive Maintenance (PM) - Tasks for VTABS shall be performed on a scheduled periodic basis. The mean time between preventive maintenance actions (MTBPMA) for any item shall not be less than 90 days. These PM tasks will be conducted to reduce the occurrence of unanticipated malfunctions and/or facility communication outages. PM tasks will:

a. Be performed while the system is in operation with minimum interference with facility operations.

b. Not cause interruption or perturbation to VTABS or facility operations.

c. Be described in VTABS technical instruction manuals.

d. Be classified into two categories: scheduled inspections and scheduled removals.

1. Scheduled inspections will include those tasks designed to identify impending failures.

2. Scheduled removal will include those tasks required to recondition items that have reached a predetermined usage or that have reached an anticipated statistical useful life.

Preventive maintenance tasks that cause a failure in operations shall be designated as corrective maintenance.

Scheduled inspection and removal tasks associated with all VTABS equipment shall be provided to the Government. The PM schedule will be provided by the government in the VTABS maintenance handbook.

The VTABS design shall be such that PM activities can be performed on a minimum of position or external interface circuits without impact to other services.

3.7.3.3 Mean Time to Repair (MTTR) - Equipment MTTR shall not exceed 30 minutes for corrective maintenance.

3.7.3.4 Maintenance Requirements - For all VTABS equipment, the MTTR shall be based on the removal and replacement of modules, using system-specialist-level maintenance technicians. In this regard, a module shall be a Line Replaceable Unit (LRU), such as a printed circuit assembly or equipment. The system shall be designed for rapid fault isolation through the designated use of automatic on-line fault isolation, BITE, and BIT capability. The VTABS shall have on-line fault-isolation capability to one or two modules in 95% of all failures, and to one module in 85% of all failures. Maintenance on the Backup subsystem shall not have any impact on the operation and availability of the Training subsystem; nor shall maintenance on the Training subsystem have any impact on the operation and availability of the Backup subsystem.

3.7.3.5 Service and Access - All modules and equipment shall be completely removable from their enclosure without excessive disassembly. All test points shall be accessible without disassembly of the equipment. The equipment shall be designed to permit modular replacement without removal of adjacent modules. Calibrations and adjustments shall be accomplished through use of either built-in meters and gages, or with portable test instruments. When safety allows, access shall be provided to modules from outside the basic equipment through the use of swing-out units, pull-out drawers with drawer slides, cable extenders, and cable retractors. The variety and number of special tools and test equipment required to maintain the equipment shall be held to a minimum.

3.7.3.6 Diagnostic Requirements - The VTABS shall provide the capability for air-traffic-controller-initiated action to confirm operability of any position functions. This confirmation will be derived from the results of automatic diagnostics that run as background activity to verify function operability. These background diagnostics will verify functionality of on-line items and off-line "power-on" items. The air traffic controller shall be able to confirm operability of the position within three (3) seconds and confirm operability of any selected function within one (1) second after request.

The VTABS shall provide the capability to verify the VTABS operability of any air traffic controller position function.

3.8 VERIFICATION AND CERTIFICATION

Verification is the determination of proper system functional operation. Verification will form the basis of VTABS Certification by FAA personnel. The functioning of the system shall be verified after each preventive , corrective or off-line diagnostic maintenance action.

The VTABS is an integrated system providing both air-to-ground (A/G) and ground-to-ground (G/G) communications. FAA Order 6000.15B requires that all systems providing A/G communications between pilots and air traffic personnel be certified. Certification is the technical verification that a system, subsystem, or equipment is providing the required service to the user (air traffic control personnel and the flying public) at any given time. It includes the government determination as to when a system, subsystem, or equipment will be continued in, restored to, or removed from use. Certification of VTABS equipment will be accomplished by FAA personnel.

3.8.1 Plan - The system, function, and equipment verification for the VTABS shall use BIT/BITE functions of VTABS and manual test procedures and equipment identified in maintenance technical documentation. Verification for VTABS shall be in accordance with maintenance technical documentation and VTABS maintenance handbook procedures.

3.8.2 BIT/BITE - Built In Test (BIT) capability is the collection of functions that allow selective testing of the functionality containing the BIT or of a closely related functionality. BITE is one form of BIT in which the test functions are resident in a set of dedicated circuits contained within, but not a part of, the functionality to be tested. The other predominant form of BIT is usually software and is associated with the system as a whole or is part of a processor within the system.

3.8.2.1 BIT/BITE Functions - Whichever form BIT/BITE takes, it shall function within the VTABS environment to: (a) permit detection and isolation of malfunctions down to the LRU, and (b) permit verification of VTABS functionality, from full system, to the LRU level.

3.8.3 Applicability - Verification shall be required in the following cases:

a. Verification of proper functional operation upon completion of preventative, corrective or off-line diagnostic maintenance actions.

b. Verification of the readiness of equipment not in service to be activated by reconfiguration activities.

c. Daily verification of system performance.

3.8.4 Reserved

3.9 SYSTEM DESIGN AND CONSTRUCTION

The VTABS shall be designed and constructed so that all specified modularity, performance, and RMA requirements shall be achieved throughout the specified service life. Construction of the system equipment shall employ standardization of cabinets, modules, printed circuit assemblies, components, materials, processes, and workmanship.

3.9.1 Interchangeability

Mechanical and electrical interchangeability shall exist among all assemblies, subassemblies, and replaceable parts that are intended to be identical regardless of manufacturer or supplier (see MIL-STD-454, Requirement 7).

3.9.2 Reserved

3.9.3 Service Life

The equipment shall be designed and constructed to have a service life of at least 20 years. During its service life, the VTABS shall operate continuously 24 hours per day.

3.9.4 Mechanical Requirements

3.9.4.1.1 Equipment Room Floor Space - The equipment room floor space required for the VTABS installation at each site shall be determined at site survey.

3.9.4.4.1.1 Existing On-Site Console and Frame Expandability - Existing consoles and frames in which VTABS equipment is to be installed shall be fully wired to accept all modules required.

3.9.4.4.3 Cable Entrance and Exit - Cabinet or frame interconnecting cables shall normally enter and exist through a raised floor. Direct cabling through the sidewall of cabinets, at least 6 in. above the floor, may be used within a subsystem where distance is considered a critical factor in circuit performance. Direct cabling shall not in any way compromise the requirements of expandability.

3.9.4.5 Distribution Frames - An intermediate distribution frames (IDF) shall be provided by the contractor to facilitate the interconnection of all VTABS cables to the FAA-provided VTABS Distribution Frame and the VSCS Transition Switch Frame, and the FAA-provided Master Demarcation System (MDS) Frame System. The IDF shall accommodate all VTABS interface requirements including the existing equipment-to-VTABS transition switch. Cables shall be provided to interconnect the IDF-to-Transition Switch Frame and the MDS as required by the site survey.

3.9.4.5.1 Distribution Frame Cabling - The VTABS shall provide all cables, cross-connects, and any additional cable trays needed. Cable and cross-connects shall be provided for:

a. VTABS back room equipment and VCE;
b. VTABS and the Contractor-provided IDF;
c. Contractor-provided IDF and the FAA-provided Transition Switch Frame;
d. Contractor-provided IDF and the FAA-provided MDS.

All cabling installations shall comply with FAA Order 6650.9, except the power/signal cable spacing specified by Paragraph 9b which shall be applicable where facility space permits.

3.9.4.6 Reserved

3.9.4.7 Reserved

3.9.4.8 Acoustic Noise Levels - Acoustic noise levels generated by the assembled and peripheral equipment shall not exceed the specifications of 3.3.7.1 of FAA-G-2100F.

3.9.4.9 Intraconnection and Interconnection Cables - The VTABS shall provide all intraconnection and interconnection cables and connectors required for factory testing, equipment site installation, checkout, acceptance testing, cutover, operation, and maintenance of the VTABS, for all VTABS installations, designed for Government-furnished underfloor and overhead distribution and cabling facilities. All cabling installations shall comply with FAA Order 6650.9, with the exception of the power/signal separation required by Paragraph 9b in those areas where facility space is insufficient to allow specified separation. VTABS cables shall connect electronic devices and modules associated with any transmission path located in consoles and the equipment room. All such cabling shall permit accessibility to equipment for test maintenance and replacement. After installation, all cabling shall meet grounding requirements and electromagnetic compatibility (EMC)/conducted and radiated electromagnetic interference (EMI) requirements. Cabling and wiring shall comply with 3.3.1.3.4.26 of FAA-G-2100F; National Electric Code, NFPA-70, and FAA-C-1217E. All interconnecting cables shall be plenum rated in accordance with NFPA-70 Section 725-38 and 800-53.

3.9.4.9.1 Cable Connectors - All cable connectors furnished on the equipment for making external connections shall be clearly identified on the plug-in side by word labels descriptive of their specific function and by the proper reference designation. The mating connector part (connector or plug) that is electrically engaged shall contain female contacts. All cable connectors shall have the capability to be mechanically retained in place.

3.9.4.9.2 Cable End Terminations - Signal cable end terminations shall be solderless, quick-disconnect terminal blocks and/or solderless, wire-wrap terminal blocks or connectors. Power cable end terminations shall be screw-type terminal blocks, pressure contact terminals blocks, or connectors. Connectors that have insert-type contacts need be loaded with only the contacts actually used plus spares. All cable terminations, as far as possible, shall incorporate a strain relief mechanism independent of the electrical conductors.

3.9.4.9.3 House Cables - House cables connecting the console with the equipment located in the equipment room shall be terminated with female connectors at the console. These cables shall be designed for overhead and underfloor distribution. Connectors that have insert-type contacts need be loaded only with contacts actually used plus spares. Each cable end and its terminating socket must be clearly marked with the proper reference designations.

3.9.4.9.4 Position Cables - Position cables connecting the console modules with other modules located at ATC positions shall be terminated with female connectors at the console module end of the cable. Connectors with insert contacts need be loaded only with contacts actually used plus spares. Each cable end and its terminating socket must be clearly marked with the proper reference designations.

3.9.4.9.5 Power Cables - All AC power cables and wiring within the VTABS shall be shielded from the voice and signaling circuits. All AC power shall be installed in accordance with National Electrical Code, NFPA-70. Cabling shall also include all junction boxes, fittings, and distribution equipment including switches and circuit breakers from the FAA power source to the VTABS primary power panel.

3.9.4.9.6 Grounding Cables - Grounding cables, wires, and buses for the ground systems specified in 3.9.14 shall comply with FAA-G-2100 and FAA-STD-019.

3.9.4.10 Cabinet Ventilation and Cooling - All blowers, vents, and cooling equipment necessary for the ventilation and cooling of the equipment shall be an integral part of the VTABS. Each cabinet requiring forced ventilation shall contain its own blower system and shall require no external ducts. The equipment shall not malfunction with access doors and plates open, and drawers extended for servicing, for up to eight (8) consecutive hours. Ventilation air intake shall be from the bottom of the cabinet; the cabinet design shall allow air intake from either below a raised floor or from floor level, by simple removal of cover plates or baffles. Air intakes shall be provided with air filters in all equipment cabinets. Ventilation exhaust shall be at the top of the cabinet through exhaust outlet openings. Ventilation exhausting from cabinets or consoles shall be designed such that no safety hazards are present to personnel in accordance with MIL-STD-454, Requirement 1. The NAS Transition Plan envisions positive-pressure, forced-air cooling for under floor spaces.

3.9.4.10.1 Overheat Warning - A warning device shall be provided in each separate cabinet to indicate when the temperature exceeds the maximum safe operating temperature for the equipment within the cabinet. The overheat warning shall also be reported and displayed at the maintenance, NAS Manager, or Master Instructor positions. Overheat warning requires maintenance personnel action to determine the cause of warning and take corrective action.

3.9.5 Environmental Requirements - The VTABS shall operate in all combinations of environmental conditions specified below. Operating conditions apply under all fixed or slowly varying conditions of ac voltage and frequency defined in 3.2.1.3 of FAA-G-2100F. Non-operating conditions, for which the environment is uncontrolled, include shipping and handling, storage, and facilities not in service.

3.9.5.1 Temperature, Humidity, and Altitude Conditions

3.9.5.1.1 Operating Environment - The VTABS shall suffer no degradation in performance when operated within the following conditions, and under all fixed and slowly-varying conditions of ac voltage defined in 3.2.1.3 of FAA-G-2100.

a. Operational temperature range: 10 to 40°C;
b. Relative humidity: 10% to 80% non-condensing;
c. Altitude: up to 6,000 feet above sea level;
d. Maximum temperature gradient: 8.3 C° per hour.

3.9.5.1.2 Non-operating Environment - The VTABS shall suffer no damage when stored, transported, or left idle (without power) under the following conditions:

a. Temperature range: -20 to +51° C;
b. Relative humidity: 5% to 95% non-condensing;
c. Altitude: up to 35,000 feet above sea level.

3.9.5.2 Vibration and Shock Design Requirements

3.9.5.2.1 Random Vibration - Random vibration design requirements are specified in accordance with MIL-STD-810E, Method 514.4, Procedure 1, Category 1 (Basic Transportation) Figure 514.4.1, on all 3 axis in a shipping container. The design exposure time requirement is 10 minutes per axis. One axis may be assumed if substantial evidence can be given to show that there is a single axis that will reveal most of the workmanship and material faults in the VTABS equipment.

3.9.5.2.2 Shock Requirements - For shipment proper packaging techniques shall be implemented to prevent damage from transportational vibration and shock. For unpackaged bench handling, the VTABS PEM hardware shall withstand a 4-inch pivotal drop and a 1-inch (free) drop from any probable direction.

3.9.5.3 EMC/EMI Surveys - EMC/EMI surveys shall verify that the VTABS is not affected by electromagnetic radiations and does not affect other FAA systems.

3.9.5.4 ESD - The VTABS PEM shall meet the Class 4 requirements of IEC 801-2.

3.9.5.5 Electromagnetic Interference Requirements - The VTABS equipment shall meet the following modified MIL-STD-461D requirements at a system level when tested to MIL-STD-462D.

3.9.5.5.1 CE102, Conducted Emissions, Power and Interconnecting Leads, 10 KHz to 10 MHz - The VTABS equipment shall meet, at a system level, the CE 102 requirements of MIL-STD-461D as indicated in Figure 3-2. The procedures of MIL-STD-462D shall be used for measurement. Conducted emissions appearing on the AC input power leads shall be below the specification limit as shown in Figure 3-2. No requirements are imposed upon the DC output power leads from the power system.

3.9.5.5.2 RE102, Radiated Emissions, Electric Field, 2 MHz to 18 GHz - The VTABS equipment shall meet the modified RE102 requirements of MIL-STD-461D for Ground Applications, at a system level. The test procedures of MIL-STD-462D shall be used for measurements. Testing shall be required up to 1 GHz or 10 times the highest intentionally generated frequency within the VTABS system, whichever is greater. Measurements beyond 10 GHz are used below the specification limit as shown in Figure 3-3.

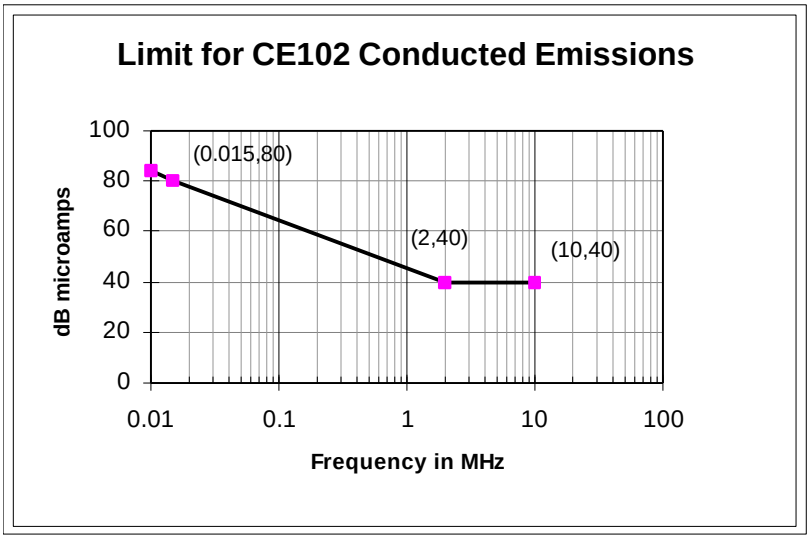

Figure 3-2: Limit for CE102 Conducted Emissions

Note:

The limit from 10KHz to 2 MHz shall be relaxed for systems with load current > 1 ampere by a factor of 20 Log (Load Current) and drawing a straight line from adjusted end point to the point where coordinates are 2 MHz and 40 dB microamps.

3.9.5.5.3 RS103, Radiated Susceptibility, Electric Field - The VTABS equipment shall meet the RS103 requirements of MIL-STD-461D at a system level as indicated in Figure 3-4. The test procedures of MIL-STD-462D shall be used for measurements. The VTABS operation shall not be affected when subjected to a 1 Volt per meter electric field strength over the 30 MHz to 18 GHz portion of the frequency spectrum. The electric field shall be pulse modulated at 1 KHz rate with a 50% duty cycle. This requirement shall be met for both horizontally and vertically polarized fields. The RS103 requirement shall be as shown in Figure 3-4.

3.9.6 Federal Communications Commission (FCC) Registration -The VTABS shall provide the capability of interfacing with common carrier facilities. All systems and subsystems interfacing directly with these facilities shall be FCC registered. FCC equipment registration shall be in accordance with 3.3.1.1 of FAA-G-2100.

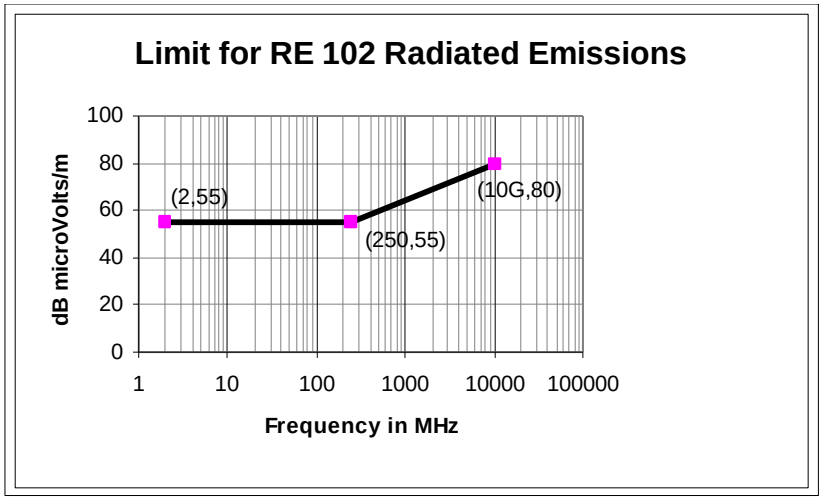

Figure 3-3: Limit for RE102 Emissions

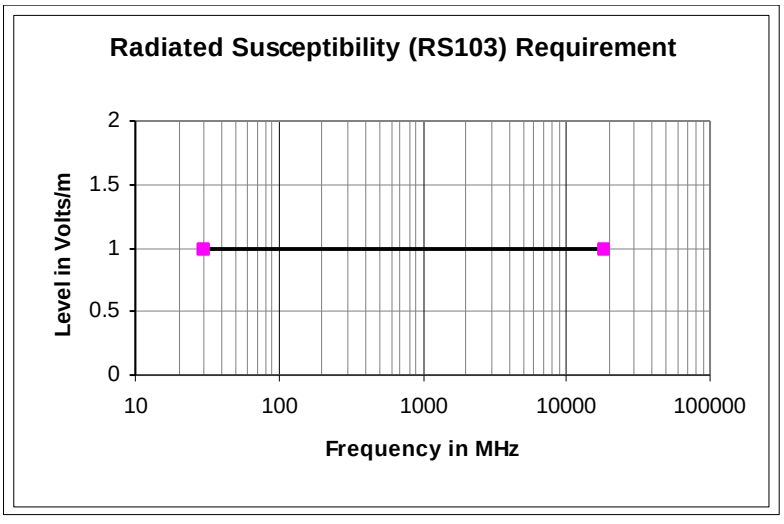

Figure 3-4: Radiated Susceptibility Requirement

3.9.7 Electrical Power

3.9.7.1 Reserved

3.9.7.2 Reserved

3.9.7.3 VTABS Site Power - The VTABS shall be capable of operating from unconditioned commercial AC line power as defined in FAA-G-2100.

3.9.7.4 VTABS Power Failure - The design of the VTABS Backup subsystem shall be such that full operational functionality shall be maintained by all VTABS Backup subsystem equipment for up to 20 minutes in the event of failure of the FAA AC power bus.

3.9.8 Power Distribution - The AC power shall be distributed to the VTABS from a single critical AC bus. The power supplied to the VTABS switching equipment will be 208 VAC line to line voltage, and will be regulated by the VTABS internal power supplies.

3.9.8.1 VTABS Backup Subsystem Independent Power Controls - The VTABS training and Backup subsystem equipment shall be provided with independent input power switches. Power control for the Backup subsystem shall be independent of the Training subsystem and vice-versa.

3.9.8.2 VTABS Backup Subsystem Reserve Power - The VTABS Backup subsystem shall provide a reserve power source for each PEM, the switching equipment, the control subsystem equipment and workstations in the Backup subsystem configuration, and the existing VSCS Transition Switch. The Backup subsystem reserve power source shall provide a minimum of 20 minutes of uninterrupted operations for the maximum sized VTABS in the event of facility critical power failure.

Status of the VTABS Power subsystem shall be reported and displayed at the maintenance and NAS Manager positions.

The VTABS Power subsystem batteries shall be able to fully recharge in 24 hours.

3.9.9 Electrical Service Conditions, Transient State - The VTABS shall conform to FAA-STD-020, pertaining to Transient Protection Requirements. No false operational or output signals shall be generated by transients within the defined limits or by inrush currents caused by the VTABS.

3.9.10 Reserved

3.9.11 Reserved

3.9.12 Reserved

3.9.13 Powerline EMI Reduction Requirements - EMI powerline filters shall be used whenever necessary to eliminate powerline-conducted emissions, in accordance with MIL-STD-461, and conducted susceptibility. All interconnections between the VTABS and external systems shall be shielded in accordance with Section 6 of FAA-STD-020. Emphasis shall be placed on equipment interconnection design and layout to reduce undesirable equipment interactions. Equipment that is susceptible to or is a source of radiated EMI shall comply with the requirements of 3.9.5.4.

3.9.14 Grounding Systems

3.9.14.1 General - The FAA will furnish the earth ground and the AC power ground at all installations. Grounding systems shall be in accordance with an approved grounding plan. Grounding systems shall be designed to prevent cross-coupling through the ground system. Centrally located, grounding shall be used to prevent ground loops and shared impedance-coupling paths. The VTABS shall use separate grounding networks as necessary for; (a) AC, (b) chassis, (c) signal, and (d) trunk circuit. These grounding networks shall be terminated on a grounding terminal block for either strap connection and/or further connection to the earth, AC, and signal grounds. Chassis and signal ground may be combined and logic/control monitor ground may be applied at the cabinet level for commercial equipment.

Grounding shall be in accordance with Section 3.8 of FAA-STD-020.

3.9.14.2 AC Ground - A common ground derived from the AC power source shall be used for all AC power in the system.

3.9.14.3 Chassis Ground - All surfaces of front panels, chassis, frames, and cabinets shall be at a common chassis ground potential. The chassis ground for equipment located at operating positions shall be obtained from the chassis ground system.

3.9.14.4 Signal Ground - The VTABS shall provide a signal ground for control, monitoring, and logic type signals.

3.9.14.5 Communications Trunk Circuit Ground - Communications trunk circuit equipment shall have a separate ground system. When interfacing with common carrier facilities, this ground shall be connected to their grounding system.

3.9.16 AC Line Receptacle and Power Cord

All receptacle and power cords shall be in accordance with 3.3.2.1.4 of FAA-G-2100.

3.10 SOFTWARE

3.10.1 Reserved

3.11 SECURITY AND SAFETY

3.11.1 Security

The security requirement on the VTABS shall be in accordance with FAA Order 1600.54, Security of FAA Automatic Data Processing Systems and Facilities.

The VTABS shall protect all information within the system. It shall protect as a minimum, data, data stores, and hardware components from unauthorized manipulation and shall provide user access verification. The VTABS shall ascertain user authorization for system entry and ensure that unauthorized users are precluded. All system entries and attempted entries shall be reported to the designated operator workstation.

3.11.2 Safety

The VTABS system shall be compliant in all aspects with OSHA Safety and Health Standards (29 CFR 1910). System safety engineering principles shall be applied throughout the design, development, manufacture, test, checkout, operation, and maintenance of the VTABS, in accordance with the following requirements of MIL-STD-454:

a. Requirement 1: Safety (Personnel Hazard),
b. Requirement 3: Flammable Materials,
c. Requirement 8: Electrical Overload Protection, Class 1 Equipment,
d. Requirement 45: Corona and Electrical Breakdown Prevention.

3.12 TRAINING AND DEPOT SUPPORT VTABS REQUIREMENTS

3.12.1 Scope

The FAA VTABS Training Switch shall provide the capability, as a minimum, to train AT and AF personnel. The AT training will include VTABS operation, master instructor functionality, and data base management. AF training will include VTABS operation, hardware maintenance, software maintenance and data base management. The instruction on hardware maintenance will include training on VTABS hardware diagnostics, maintenance diagnostics (at the maintenance position) plus removal and replacement of Line Replaceable Units (LRUs). The instruction on software maintenance will include, at a minimum, system initialization (cold and warm starts), system reconfigurations, and data base management.

3.12.2 Airway Facilities Requirements

The government provided AF Training Facility at the Mike Monroney Aeronautical Center (MMAC) will consist of two identical laboratory classrooms, a transition switch and a VTABS Switching Equipment (VSE) room, which will be located adjacent to the two laboratory classrooms. The VSE room shall contain the VTABS switching equipment and one maintenance console. The government provided AF Training Facility at the contractor's facility will consist of one laboratory classroom, a transition switch and a VTABS Switching Equipment (VSE) room.

3.12.2.1 Airway Facilities Laboratory Classroom(s) -

a) Each laboratory classroom shall provide the capability to simultaneously train, on a non-interfering basis, 12 students supported by one instructor.

b) Each laboratory classroom shall provide 13 VTABS Supervisory positions, or 13 data entry positions, or 13 workstation terminals for software maintenance training.

c) The workstation terminals shall support software maintenance training as defined in Section 3.12.3.

d) Each laboratory classroom equipment shall be designed to be housed in a 1000 square foot classroom.

e) The laboratory classroom equipment shall be mounted on AF Student Workstations that shall provide:

1) 18" by 36" unobstructed work space,

2) an unobstructed view of the front of the laboratory classroom, e.g., the student will have a clear view of the instructor, chalkboard, etc., and

3) a storage area (below the level of the workspace) for VTABS course and reference materials.

3.12.2.2 VSCS Maintenance Position -

a) The maintenance position shall be located in the equipment room.

b) The interactive display units shall be capable of driving a large screen display(s) readable from a distance of 10 feet.

c) Both the position and the large screen display(s) shall be situated to allow for VTABS maintenance diagnostics demonstrations and training.

3.12.2.3 Airway Facilities VTABS Switching Equipment (VSE) Requirements -

a) The VSE shall be designed to be installed in a 2000 square foot equipment room.

b) The VSE shall be equipped with:

1) 32 Radio/Interface Cards
2) 25 BUEC Interfaces
3) 95 Trunks
4) 1 Analog Telephone
5) 28 PEMs (Classrooms - 26, Maintainer - 1 and DSR Mockup - 1)
6) 2 Workstations (1 Maintainer and 1 DEO) and Printer
7) Transition Switch and Two Remote Operator Terminals

3.12.2.4 Airway Facilities Requirements - Facilities provided at the site for cadre and familiarization training shall include equipment required to teach equipment familiarization.

3.12.3 Airway Facilities Equipment Functional Requirements

The VTABS for AF training shall provide the functionality of an operational site both for the backup switch and the training switch. These functions shall be accomplished, whenever possible, in the absence of external communications equipment, e.g., Backup Emergency Communications (BUEC), radio interfaces and trunks.

a) The 12 student and one instructor VTABS supervisory positions shall be capable of simultaneous log-on and shall be capable of providing all supervisory functions.

b) The 12 student and one instructor VTABS data entry terminals shall be capable of simultaneous log-on and shall be able to perform all data entry functions.

c) The 12 student and one instructor VTABS software workstation terminals plus the software support equipment shall support software overview training and software maintenance and development training that includes:

Level 1-Software overview, introductory, and familiarization training in the AF VSCS laboratory classrooms for air traffic control facility users. This training will include software architecture, maintenance analysis, and error messages.

3.12.4 AT Requirements Reserved

3.12.4.1 AT Classrooms Reserved

3.12.4.2 AT Facilities Requirements - Facilities provided at the site for cadre training shall include equipment required to teach equipment familiarization.

4.0 QUALITY ASSURANCE PROVISIONS

The VTABS shall be produced in accordance with Quality Assurance (QA) provisions that provide continuing system verification throughout the VTABS procurement program. These provisions shall ensure that engineering design and development are complete, the design risks are minimized, and that all delivered hardware, software, and documentation meet specified requirements. The quality assurance provisions shall also ensure that the methods of design, construction, inspection, and testing provide early detection of deficiencies and assure prompt, effective corrective action.

Formal Quality Assurance plans and procedures applied to the VTABS system shall meet the requirements of ANSI/ASQC -9001-1994 and ISO 9000-3. The quality program shall include a hardware quality control system to monitor all materials and equipment, and a software quality control system to monitor all software in accordance with the contract.

In addition, end item and in-process tests shall verify that VTABS hardware and software meet the requirements of Section 3 of this specification. Test programs shall be in accordance with the FAA-approved Contractor Master Test Plan.

4.1 GENERAL

The VTABS quality assurance effort shall cover all hardware and software provided in the system to ensure that appropriate standards for software and hardware design and fabrication are followed and that all subcontractor and vendor items are in accordance with all contract requirements. All quality assurance activities shall be in accordance with Quality Assurance plans. All test activities shall be in accordance with the FAA-approved Contractor Master Test Plan.

4.1.1 Quality Management and Responsibilities

The quality assurance program shall be managed by the Contractor and will be reviewed by the Government.

4.2 QUALITY CONTROLS

The quality controls identified in this section ensure the quality of the system hardware and software developed under this program. Throughout the entire VTABS production period, inspections, reviews, and audits will be applied on an ongoing basis to ensure the quality of the product.

Formal testing will be used to verify that the design(s) meet the requirements of this specification. These tests will be conducted at subcontractor, prime contractor, and FAA facilities. Tests by the subcontractor and contractor will demonstrate adherence to specifications and verify readiness for delivery. Tests by the FAA will verify acceptability of the system and assess operational usability.

4.2.1 Hardware Quality Control Program

The hardware quality control system shall provide for inspection and testing according to written standards of quality that specify definitive, measurable criteria to enable such inspections and tests to confirm compliance with these standards and to assure that all delivered materials and equipment meet contract requirements. Included are control of purchased material procedures to ensure the acceptable quality of subcontractors' and other suppliers' equipment, and test control procedures for each configuration item to ensure the validity of all tests and results.

4.2.2 Software Quality Control

The software quality assurance program shall be established and maintained to meet requirements of " ANSI/ASQC Q 9001-1994 and ISO-9000-3".

Written standards of quality shall specify definitive, measurable criteria to enable inspections and test to confirm compliance with these standards and to assure that software meets contract requirements.

4.2.2.1 Software Stability Tests - The contractor shall conduct a Software Stability Test to prove the system's ability to provide continuous, uninterrupted A/G and G/G communications. The operational software shall be tested in as realistic an environment as is possible in the contractor's facility as part of the FAT. During the functional testing of the operational system, software stability shall be ensured over a 48 hour period of continuous 24 hour/day operation. Traffic load rates, as defined in Table III, shall be maintained at 100% PBH. Reconfigurations, Supervisory functions, and Preventative Maintenance actions shall be performed during the stability test. The stability test shall be conducted on the back-up portion of the VTABS. The VTABS shall be capable of being automatically loaded from the Position Electronics Module (PEM). The PEM shall have an interface port to accommodate automated loading. The contractor shall provide the interface characteristics to the Government Appointed Test Director at the conclusion of PEM System Integration and Test. VTABS stability test pass/fail criteria shall be in accordance with information provided in the contract.

4.2.2.2 Software Stress Tests - Software stress tests shall include unexpected or extreme conditions as follows:

a. Erroneous inputs.
b. Maximum or overload processing demands.
c. Simulated failure of software and induced failure of hardware components.
d. Unexpected conditions that may occur in the operational environment.

4.2.2.3 Test Results - The software test results shall identify the following:

a. Nominal behavior of the software,
b. Range of functions that can be accomplished successfully by the software,
c. Error in the software,
d. Special cases requiring additional testing,
e. Ability to survive erroneous inputs,
f. Ability to meet voice intelligibility (3.4.2.3.8.4) and voice delay (3.2.2.2.28) requirements.

4.2.3 Design Reviews, TIMs, and Configuration Audits

The VTABS design shall be reviewed and audited at key points during the contract to assess the progress of the development process and the quality of the evolving system.

4.3 RESERVED

4.4 RESERVED

4.5 RESERVED

4.6 RESERVED

4.7 TEST EQUIPMENT

For tests conducted on site, all necessary test equipment shall be delivered to the FAA on time, calibrated, and fully operational to support all tests. Use of FAA test equipment may be possible where this test equipment is on site and is available and meets all specified test equipment requirements. All test equipment used during the factory or site tests shall be standard commercial equipment and shall not be modified. The test equipment shall operate in the manner specified by the test equipment manufacturer. Use of custom test equipment or modified commercial test equipment requires approval in writing by FAA. Recalibration of test equipment used in the test program may be required due to the following:

a. The test equipment is removed from the test setup for unrelated purposes, or

b. The test equipment fails or is damaged, or seems to be operating in a faulty manner based on FAA evaluation of test results.

4.8 RETEST

The reasons for all failures and noncompliances shall be determined. All corrective action necessary shall be taken to ensure full specification compliance. All repair or rework shall be completed prior to submission for retest. The FAA will determine the extent of retest required. No retest shall be started until all documentation has been submitted concerning the noncompliance and the corrective action taken, and the FAA agrees to start the retest. If a review of the reasons for failure to comply with specification requirements indicates that the cause may exist as latent defects in items previously accepted, the defects in all units shall be corrected in a timely manner, even those previously accepted by the FAA.

4.9 FACTORY TEST

A complete series of factory tests on the VTABS equipment and software and on operation and maintenance procedures shall be performed. These factory tests shall demonstrate that all hardware, software, and performance requirements are met. The factory test procedures shall list all test equipment and test software used.

The make, model, serial number, and certification data of the test equipment shall be identified. The procedures shall have step-by-step instructions. The test procedures shall correlate the requirement being verified to the step in which it is verified. Test equipment interconnection with equipment under test shall be explicitly described in graphical and textual form. Functions, data interfaces, and interactions of test software shall also be clearly defined and identified in the test procedures.

4.9.1 Design Qualification Tests

A complete series of design qualification tests on the VTABS shall accomplish two purposes. First, these design qualification tests shall verify that the design is adequate to meet specification requirements for the maximum size system. These tests shall verify that allocated function and performance requirements are fully satisfied. Second, the design qualification tests shall verify that the performance of the equipment and software at all levels of implementation is adequate to warrant commencement of other FAA-witnessed tests.

4.9.1.1 Environmental Qualification Tests - Environmental qualification tests shall include vibration screening and electromagnetic compatibility (EMC). For unmodified subsystems that have completed a qualification process previously, specifications, plans, procedures, reports, and other related documents shall be submitted for approval.

4.9.1.1.1 Vibration-Screen and Shock Testing - Vibration-screen and shock testing shall be in accordance with the requirements of 3.9.5.2.1 and 3.9.5.2.2 for untested or modified subsystems and system.

4.9.1.1.2 Reserved

4.9.1.1.3 EMC Testing - Testing on subsystems and systems shall be in accordance with the requirements of 3.9.5.4. Test procedures shall be in accordance with MIL-STD-462, except as noted in the requirements.

4.10 SITE ACCEPTANCE TESTS

Prior to shipment of VTABS components to site, there shall be a 48 hour burn-in test of VTABS components at the chassis level.

The site tests shall demonstrate that all external interfaces operate properly and that all VTABS requirements can be fully met for both incoming and outgoing data exchange. The site tests shall demonstrate that the system is fully compatible with and operable in the government-furnished facilities.

SAT shall include verification of one site database map for each of the Backup and Training Subsystems.

The make, model, serial number, and certification data of the test equipment shall be identified. The procedures shall have step-by-step instructions. Test equipment interconnection with equipment under test shall be explicitly described in graphical and textual form. Functions, data interfaces, and interactions of test software shall also be clearly defined and identified in the test procedures.

4.11 QUALITY CONFORMANCE REQUIREMENTS

The Contractor Master Test Plan shall delineate each specific VTABS requirement to be demonstrated during the test. Included with each requirement will be an indication of the method to be used to demonstrate the requirement, the expected output or results, and how the results will be analyzed to determine success or failure. In each formal test procedure, the requirement identification will be noted at the beginning of the procedure steps which test the requirement. Requirement identification will consist of the number used in this specification.

The requirement identifications called out in the test plan will be noted one or more times within the associated procedure. Each test report will contain a section that delineates all requirements demonstrated during the test followed by an indication of the actual output or results and a statement concerning the success or failure of the demonstration. The Requirements Verification Methods described in 4.12 shall be the basis for a table to show the method the Contractor plans to use for requirements verification. This table, the Requirements Verification Methods Table (RVMT), shall be included and maintained in formal test plans. The corresponding test report for each test plan will include the VRMT updated to reflect the relative completeness of requirement satisfaction and the deviations or liens necessary to proceed to the next level of test activities.

4.12 REQUIREMENTS VERIFICATION METHODS

The following is a methodology used to verify adherence to requirements specified. The verification methods include: Analysis, demonstration, test, and inspection. Each requirement and method of verification shall be presented in tabular form.

4.12.1 Implementation of Verification Methods - These verification requirements shall be mandatory for use in all testing of the VTABS. Where applicable, pass/fail criteria for each verified requirement shall be defined and placed in the appropriate documentation. Failure to "pass" the appropriate verification action(s) (analysis, demonstration, test or inspection) shall be cause for rejection. No adjustments to the equipment shall be allowed during verification. Upon evaluation of the cause of the failure and the implementation of proper corrective measures, the verification in which the failure occurred shall be repeated. If the corrective action has an impact on prior verifications or if a computer program is changed, or if any hardware is changed, then the prior verification shall be repeated. Representative data to prove that an item meets specification requirements may include data collected from previous or other equipment and system verifications. Each verification method is detailed in the following sections.

4.12.1.1 Analysis - Analysis is verification by technical/mathematical evaluation or simulation using mathematical representation (i.e., mathematical models, algorithms, equations), charts, graphs, circuit diagrams, data reduction/recording and representative data to prove that an item meets specified requirements.

4.12.1.2 Demonstration - Demonstration is an uninstrumented test, where success is determined from observation alone. Included in this category are tests whose results can easily be determined on a pass-fail basis.

4.12.1.3 Test - Test is verification, through systematic exercising of the item under all appropriate conditions with collection, analysis, and evaluation of quantitative data for predetermined performance characteristics. Acceptability of the item is determined by the comparison of the data with pre-established quantitative requirements and occurrences.

4.12.1.4 Inspection - Inspection is verification by visual examination of the item, reviewing descriptive documentation and comparing the appropriate characteristics with a predetermined or referenced standard to determine conformance to requirements without the use of special laboratory equipment or procedures.

5.0 PREPARATION FOR DELIVERY

5.1 GENERAL

The contractor shall guarantee the equipment integrity from factory to final installation site. The Contractor shall comply with the relevant standards identified in Section 2.0.

5.1.1 Level of Preservation Protection

The level of preservation shall afford adequate protection against corrosion, deterioration, and physical damage during shipment from the supply source to the receiving activity at the FAA where the item may be subject to immediate use or storage.

5.1.2 Level of Packing Protection

The level of packing shall afford protection against damage during direct domestic shipment from the supply source to the first receiving activity for immediate use. This level, in general, will conform to applicable carrier rules and regulations.

5.2 PACKING

Equipment packed for shipment to another location or to a Depot shall be packed such that it will not be damaged in transit. The equipment shall be checked and suitably packed for heavy components, such as transformers, which may need additional bracing or support to avoid damage in the event the container is dropped during handling.

5.3 SHIPMENT

Shipment of all material and equipment required for VTABS installation at any site shall be the responsibility of the contractor including off-loading and emplacement of equipment. Shipment of VTABS equipment from the contractor's plant to a specific site within the continental limits of the United States shall be by a padded electronic-equipment-type moving van.

6.0 ACRONYMS, ABBREVIATIONS, DEFINITIONS, TERMS, AND FORMULAS

6.1 ACRONYMS AND ABBREVIATIONS

AAS	Advanced Automation System
AC	Alternating Current
AF	Airway Facilities
AFI	Automatic Fault Isolation
A/G	Air-to-Ground
AGC	Automatic Gain Control
ANSI	American National Standards Institute
ARTCC	Air Route Traffic Control Center
AT	Air Traffic
ATC	Air Traffic Control
ATCS	Air Traffic Control Specialist
ATCT	Air Traffic Control Tower
ATIS	Automated Terminal Information Service
AWACS	Airborne Warning and Control System
BIT	Built-In Test
BITE	Built-In Test Equipment
BITS	Built-In Test Sequences
BSTR	Bell System Technical Reference
BUEC	Backup Emergency Communications
CA	Common Answer
C/C	Common Console
CFCF	Central Flow Control Facility
CHI	Computer-Human Interface
CSC	Computer Software Component
CSCI	Computer Software Configuration Item
CTSU	Contractor Traffic Simulation Unit
DA	Direct Access
DAPS	Display and Planning System
DC	Direct Current
DEO	Data Entry Operator
DJM	Dual Jack Module
DOD-SSP	Department of Defense - Single Stock Point
DSR	Display System Replacement
DT&E	Developmental Testing and Evaluation
DYSIM	Dynamic Simulation
ED	Entry Device
EIA	Electronic Industries Association
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
ESD	Electrostatic Discharge
FAA	Federal Aviation Administration
FAAAC	FAA Aeronautical Center
FAATC	FAA Technical Center
FCC	Federal Communications Commission
FPA	Fix Posting Area
FTS	Federal Telecommunication System

G/G	Ground-to-Ground
GFE	Government-Furnished Equipment
GMT	Greenwich Mean Time
HS	Headset
HS/LS	Headset/Loudspeaker
IA	Indirect Access
IC	Intercom
ICD	Interface Control Document
ICSS	Integrated Communications Switching System
ID	Identification
IDF	Intermediate Distribution Frame
IEC	International Electrotechnical Commission
I/O	Input/Output
IOC	Initial Operating Capability
IP	Interphone
IRD	Interface Requirements Documents
ISSS	Initial Sector Suite System
LCD	Liquid Crystal Display
LRU	Line Replaceable Unit
LS	Loudspeaker
LTP	Logical-to-Physical
MBRT	Mean Bench Repair Time
MDS	Master Demarcation System
MIL-STD	Military Standard
MPS	Maintenance Processor System
M/S	Main/Standby
MTBCF	Mean Time Between Critical Failures
MTBF	Mean Time Between Failures
MTBPMA	Mean Time Between Preventive Maintenance Actions
MTBUMA	Mean Time Between Unscheduled Maintenance Actions
MTTR	Mean Time to Repair
MTTR(S)	Mean Time To Repair for the System
NAS	National Airspace System
NPFC	Naval Publications and Forms Center
OT&E	Operational Testing & Evaluation
OVR	Override
PABX	Private Automatic Branch Exchange
PBH	Peak Busy Hour
PBM	Peak Busy Minute
PC	Personal Computer
PCS	Power Conditioning System
PDL	Program Design Language
PEM	Position Electronics Module
PM	Preventive Maintenance
PSTN	Public Switched Telephone Network
PTT	Push-to-Talk
QA	Quality Assurance

RCE	Radio Control Equipment
RCF	Radio Control Facility
REC	Recording
RDCC	Research & Development Computer Complex
RI	Radio Interface
RMA	Reliability, Maintainability, Availability
RTQC	Real-Time Quality Control
RX	Receive
SAD	Site-Adaptation Data
SPL	Sound Pressure Level
SPS	Software Production Specification
SPS	System Performance Specialist (Also)
SPST	Single Pole - Single Throw
S/S	Sector Suite
SSCC	System Support Computer Complex
SST	System Shakedown Testing
STD	Standard
TCCC	Tower Control Computer Complex
TCS	Tower Communications Switch
TED	Touch Entry Device
TEPD	Talker Echo Path Delay
TEPLL	Talker Echo Path Loudness Loss
TMDE	Test, Measurement & Diagnostic Equipment
TMVS	Traffic Management Voice Switch
TSU	Traffic Simulation Unit
TX	Transmit
UHF	Ultra-High Frequency
VCE	VSCS Console Equipment
VCET	VCE Trainer
VDF	VTABS Distribution Frame
VDM	Video display Module
VF	Voice Frequency
VHF	Very High Frequency
VOX	Voice-Operated Switch
VSCS	Voice Switching and Control System
VSE	VSCS Switching Equipment
VTABS	VSCS Training and Backup Switch
WECO, WE	Western Electric Company
WECO,300/301	Four-wire telephone key systems employed at large ATC facilities
XTS	External Time Source
0TLP	Zero Transmission Level Point

6.2 DEFINITION AND TERMS

Action, Continuous Touch - A manual operation at the VTABS human/system interface which initializes and uses certain communication circuits and VTABS controls that are activated for the duration of the continuous touch action, and deactivated with the cessation of the continuous touch action.

Action, Single Touch - An operation that occurs at the VTABS human/system interface which affects communication circuits and VTABS controls in one of two ways: (1) momentary-to-make (latch or enable), and (2) momentary-to-break (unlatch or disable).

Active Call or Position Active Call - A call (placed or received) under the control of position operator, and to which they are conversant.

Active Position - An operable controller position functioning with respect to a configuration map.

Active Sector - A sector in which air traffic control is provided in one or more assigned fix posting areas.

Address:

a. A character or group of characters that identifies a register, a specific part of storage, or some other data source or destination,

b. To refer to a device or an item of data by its address.

Advanced Automation System (AAS) - a system of four computer complexes that support air traffic control. The four computer complexes are:

a. Area Control Computer Complex (ACCC) at ARTCC and AFC,
b. Tower Control Computer Complex (TCCC) at Air Traffic Control Tower (ATCT),
c. System Support Computer Complex (SSCC) at FAATC,
d. Research and Development Computer Complex (RDCC) at FAATC.

Air Traffic Control Position - A common console configured primarily for en route, en route support or terminal air traffic control activities.

Air Traffic Controller - A person authorized to provide air traffic service including en route and terminal approach control.

Ancillary Position - A common console configured primarily for non-air traffic control activities.

Area-Level Reconfiguration - Reconfiguration affecting an area's communications and functional capabilities.

Area Map - A correspondence set wherein the communications assignments and control capabilities of an area (predetermined sets of sector suites) within a facility are defined. A correspondence set between the physical maps and configuration maps of grouped sector suites (see Switch Map).

Assembly - A number of parts or subassemblies or any combination thereof joined together to perform a specific function and capable of disassembly.

Assign - A VTABS configuration action that provides specific A/G, G/G communication connectivity capabilities and other communication feature capabilities to air traffic control and ancillary positions.

Assigned Frequency - A frequency in an air traffic control position map made available for use at a position. Frequency assignment implies only the availability of the transmitter and receiver to the position.

Background Mode - In a multi-program system, the condition under which low-priority programs are executed. The execution of data processing operations that are secondary to real-time voice switching and control.

Background Noise - Noise level present on a connected voice circuit.

Backup - Provision for an alternate means of operation in case the primary means is not available.

Back up - The act or process of making a backup.

BUEC (Backup Emergency Communications) - A secondary backup A/G communications network that is independent of primary A/G communications transmission paths and equipment. BUEC is not the same as the backup A/G switch.

Busy - A condition that exists when a called position has an active call in progress and a full CA queue. A call processing tone that is generated when the above condition exists at a called position (G/G only).

Call - A demand to set up a communication connection.

Call Features - Call forwarding, call monitoring, supervisory recording, headset or loudspeaker call routing, call queuing with caller identification, etc. Types of calls are made in certain modes with certain features invoked; for example, an interphone (type), indirect access (mode), override (feature) call that is monitored (feature) and recorded (feature) by the calling party's supervisor.

Call Forwarding - A switch-provided call feature that permits the user to instruct the switching equipment to redirect G/G calls destined for one position to an alternate position.

Call Modes - Direct access, indirect access, and voice call (G/G only).

Call Transfer - A switch-provided call feature that allows a user to redirect a G/G call that has either been answered or that is in the CA queue at a given position to another position.

Call Types - Intercom and interphone (G/G only).

Calling Line Identification or Caller ID - A switch-provided feature whereby a call source is automatically identified to the called position.

Catastrophic Failure - Failure that is both sudden and complete.

Channel - A communication path providing one-way or two-way transmission between two terminations.

Circuit -

a. A network providing one or more closed paths.
b. An interconnection of electrical/electronic elements.
c. A conductor or system of conductors through which an electrical current is intended to flow.

Classmark - An object program code that enables or disables access to VTABS services and functions. A service classmark enables or disables the class of service with respect to a trunk circuit, mainly its signaling as defined by an Interface Control Document(ICD). An operational classmark enables or disables position access to VTABS communication capabilities.

Commercial Standard - Standard established by a commercial organization or corporate entity governing design, development, documentation, control, manufacture, production, testing, etc., of its commercial and internal products.

Common Answer - A switching function whereby certain G/G calls incoming to a position are directed to a queue to be selectively answered by the position user (also known as automatic call parking).

Common Console - A standardized, human-engineered equipment cabinet including a work surface with provision for physical devices including: main display, interactive display, data entry keyboard, keypad, communications jacks, loudspeakers, and VTABS panel. Various configurations of physical devices provide for air traffic control and ancillary activities.

Complete Failure - Failure resulting from deviations in characteristics beyond specified limits such as to cause complete lack of the function.

Configuration - The arrangement of a computer system or network as defined by the nature, number, and the chief characteristics of its functional elements. The functional or physical characteristics (or both) of systems hardware/software.

Configuration Map - A correspondence set between VTABS hardware elements and software elements based on their chief functional and physical characteristics in an arrangement that provides communications assignments and capabilities through applications of operational and service classmarks (also see Program Control).

Connectivity - An established circuit.

Contrast Ratio - The ratio of the maximum to the minimum luminance values in a display device (color or monochrome).

Control Sector - An airspace area of defined horizontal and vertical dimensions for which a controller, or group of controllers, has air traffic control responsibility. Control sectors are established based on predominant traffic flows, altitude strata, and controller workload. Pilot-controller communications during operations within a control sector are normally maintained on discrete frequencies assigned to the control sector.

Controller - See Air Traffic Controller.

Controller Position - A console configured for en route air traffic control activity.

Critical Failure - A failure that is likely to result in injury to persons and or significant damage to material.

Cross-Coupling - A switch-provided feature wherein the received voice on one frequency in a pair of frequencies is transmitted over the other frequency of that pair without operator intervention.

Crosstalk Index - The probability, expressed in percent, of a system user hearing one or more intelligible crosstalk words during a call. In the Bell System, for the Loop Plant, the recommended performance objective for network planning and equipment design is that a 0.1% crosstalk index not be exceeded for 99% of the loops in the plant.

Cutover - The final change of operation from the present ARTCC communication systems to VTABS.

Database - A collection of data fundamental to the operation of a system or enterprise. Database usually connotes a systematized collection of data that can be immediately accessed and manipulated by a system for a specific purpose. Data Bank describes any collection of data that may or may not be interrelated or immediately accessible by a system.

Data Entry Device - Device located at the console which is used to enter data into the VTABS.

dBm - A logarithmic measure of a power with respect to a reference power of milliwatt (one one-thousandth of a Watt).

dBm = (10) log (P/0.001 Watt)

dBm0 - A logarithmic measure of power (in dBm) at the Zero Transmission Level Point (0TLP) to produce the same power in dBm at another point in the circuit using a 1.0 KHz tone.

dBmC0 - The test tone 1000 Hz power level measured at the 0TLP using a "C" message weighting network.

dBrn - A logarithmic measure of power with respect to a reference power of one picowatt (-90 dBm), used for noise tests.

0 dBm = 90 dBrn or dBrn = (10) log ($P/10^{-12}$ Watt)

dBrnC - A logarithmic measure of power relative to a noise reference of -90 dBm as measured with a noise meter weighted by a special frequency function called C-Message Weighting. The interfering effect of noise given in dB above a noise reference of -90 dBm at 1.0 KHz measured with a C-message filter.

dBrnC0 - Noise measured in dBrnC and referred to the 0TLP.

Decibel (dB) - A logarithmic measure of the ratio between two powers.

dB = (10) log (P2/P1)

Degradation Failure - Failure that is both gradual and partial.

Deselect - An action at an ATC or ancillary position touch entry device or interactive display that results in the deactivation of an A/G communication connectivity at that position.

Deselection - Causing the state of a selected feature of the VTABS to change to not selected.

Designator - A name, entitlement, or distinctive mark intended to point out, assign, indicate, or specify.

Direct Access - A call mode wherein the entire call processing sequence required to establish circuit connectivity is accomplished as the result of a single touch action (G/G only).

Disable - The deactivation of the communication connectivity between the VTABS and the radio interface as a result of a DESELECT (A/G only). The deactivation of any VTABS feature or control function.

Disabled Receiver - A receiver, either main or standby, for a selected frequency at an air traffic control position which the position operator has indicated will not be used for the reception of voice at the position. Disabling a receiver at a position does not affect its enabled or disabled status at any other operational position. Equivalent to locally muting the receiver.

Disabled Transmitter- A transmitter, either main or standby, for a selected frequency at an air traffic control position which the position operator has indicated will not be used for the transmission of voice from the position. Disabling a transmitter at a position does not affect its enabled or disabled status at any other operational position.

Electronic Patch Panel - Provides a capability of remote access for the purpose of testing and monitoring individual or grouped VTABS voice paths.

E&M - A signaling method for transferring supervisory and control information over a trunk circuit using the signal circuits "E" and "M" leads. The "E" lead transmits into the trunk circuit and the "M" lead transmits into the signal circuit.

Emergency Frequency - See Guard Frequency.

Enable - The activation of the communication connectivity between the VTABS and the radio interface as a result of SELECT (A/G only). The activation of any VTABS feature or control function.

Enabled Receiver - A receiver, either main or standby, for a selected frequency at an air traffic control position which the position operator has indicated will be used for the reception of voice at the position. Enabling a receiver at a position does not affect its enabled or disabled status at any other operational position.

Enabled Transmitter - A transmitter, either main or standby, for a selected frequency at an air traffic control position which the position operator has indicated will be used for the transmission of voice from the position. Enabling a transmitter at a position does not affect its enabled or disabled status at any other position.

Erlang - A unit of telephone switch traffic intensity measured in number of arrivals per mean service time. For carried traffic measurements, the number of erlangs is the average number of simultaneous connections observed during a measurement period.

Facility Backup - The act or process of backing up a failed ARTCC by expanding the controlled sectors of adjacent ARTCCs to encompass the control sectors of the failed ARTCC with respect to navigation, surveillance, control and advisory voice and data communications necessary for continued safe air traffic control.

Facility-Level Reconfiguration - A change of communication assignments and control capabilities wherein the modification or changeover occurs with respect to facility maps (also see Facility Backup and Reconfiguration).

Facility Map - A correspondence set wherein the communications assignments and functional capability of an entire facility are defined. A correspondence set between the physical maps and the configuration maps of all sector suites.

Fail Soft - If a failure occurs, that failure will not disrupt the entire system. There may be degradation of service, but basic service will continue.

Fail Soft/Fail Safe - A designed property of an item which prevents its failures being critical failures.

Federal Telecommunications System (FTS) - A leased communications service for use by the U.S. Government.

First Article System - A prototype system upgraded after production award.

First Production System - The initial production equipment.

Fix Posting Area - A volume of airspace, bounded by a series of connected line segments with altitudes, which is assigned to a sector.

Flashing - A visual signal interrupted 60 times per minute with a 50:50 on:off ratio.

Fluttering - A visual signal interrupted 720 times a minute with an 80:20 on:off ratio.

Foot Candle - The illumination on a surface one (1) foot square on which there is a uniformly distributed flux of one (1) lumen.

Foot Lambert - Photometric brightness equal to that of a perfectly diffusing surface emitting or reflecting light at the rate of one (1) lumen per square foot.

Frequency - A part of the radio spectrum used by the FAA to carry communications between controllers and pilots. The spectrum contains ultra-high (used for military air traffic) and very high frequencies (used for civilian traffic).

Frequency Allocation - Designated radio frequency bands for use by specific radio services. Air traffic control frequency allocations used by the FAA are:

118.000 MHz to 135.975 MHz for civilian aircraft
225.0 MHz to 399.95 MHz for military aircraft

Frequency Pair - A combination of VHF and UHF frequencies used as a single radio communication channel.

Full Image - Pertaining to a disk or tape; a faithful likeness of the subject matter on the original.

Functionality- The characteristic of one or more equipment whose configuration provides the capability to perform specified activities.

Functional Path - The set of physical items/equipment necessary to initiate, sustain, and terminate operation of a given function (e.g., radio, IC, or IP).

Grade of Service - The proportion of total calls, usually during the peak busy hour, which cannot be completed immediately or served within a prescribed time.

Gradual Failure - Failure that could be anticipated by prior examination or monitoring.

Guard Frequency - A designated point in the radio spectrum to which radio equipment is kept tuned expressly to monitor for and to make emergency broadcasts. The FAA uses 121.50 MHz and 243.0 MHz as guard frequencies.

Handoff - Turning over air traffic control of an aircraft from a controller of one sector to another controller of an adjacent sector or terminal.

Handoff Function - Turning over control of an aircraft to another controller or facility.

HOLD - The capability of suspending a call in progress while placing or answering another call.

Human/System Interface - See Man/Machine Interface.

Idle Channel Noise - Noise level present on an unconnected voice circuit.

Indirect Access - A call mode wherein the call processing sequence required to establish a communication link or to select a control function is accomplished by entering multi-digit numbers on a remote keypad. The keypad is activated by selecting the IA mode.

Industry Standard - Standard established by authority of a professional, technical, or industrial organization (association, institute, society, etc.) such as ANSI, EIA, or IEEE.

In-Service Circuits - Those time-shared circuits of the system which achieve a desired grade of service. The failure of one or several will not make the system inoperative, but may degrade the service during peak load.

Intelligible Crosstalk - The speech signal transferred from one voice channel to another which is sufficiently understandable under pertinent circuit and room noise conditions that meaningful information can be obtained by the disturbed party.

Interactive Display Panel - A VTABS display panel that provides access to A/G and G/G communications.

Intercom - A type of call that provides stations (positions) intra-facility communications on a voice switch. Communications between controllers at the same facility.

Intermediate Distribution Frame - A distributing frame used to terminate in-house cabling.

Interphone - a type of call that provides VTABS positions interfacility communications. Communications between controllers at different facilities.

Latching - A function that either is or emulates a push-button that locks in the down position upon a first touch, and requires a second touch to release the locked condition. The desired activation is in effect for the time the button is in the locked position.

Line - A family of equipment and devices designed to provide users with access to a choice of communication services and features. A physical channel between the VTABS position equipment and G/G and the VTABS main frame.

Line Circuit - The circuitry required to terminate, convert, and provide transmission, supervisory and control signals at the position side of the interconnection networks, and at the position and/or equipment end instruments. This circuitry can be divided between actual network terminations and position equipment terminations. This includes all circuitry that interfaces the position with the interconnection networks and the common control.

Line Replaceable Unit (LRU) - Any system item that is replaceable at the organizational maintenance level without using any special tools.

Local Muting - The muting by VTABS of voice received from the radio interface at the operational position activating the muting function for selected frequencies.

Lockout - The inability of one or more users to initiate voice transmission on a given circuit because that circuit is already enabled or in use (see Push-to-Talk).

Logical Console Identifier - An alphanumeric string of up to 8 characters which is used within the VTABS configuration maps to represent an unspecified physical console, that is, a physical console whose physical console identifier has not yet been designated. A console's logical console identifier, in conjunction with the VTABS Physical Console Assignment Mapping, permits the physical location of that console to be uniquely determined.

Logical Map - Map that defines position identification for communications connectivity independent of the position's physical address.

Loop-Back Testing - a standard telephone test procedure involving accessing the circuit at any test access point and sending test signals down the line. The test signals are returned (looped back) to the test access point where diagnostics are then performed on the returned test signals. The loop-back points are located progressively further away from the test access point until either the fault has been detected or the entire circuit has been tested.

Main Distribution Frame - A distributing frame used to terminate leased and Government-owned long-line facilities on the one side and cable pairs for line and trunk equipment terminals associated with a switching system on the other side. The main distribution frame is the interface point used for associating any outside line or trunk with any desired equipment terminal or with any other outside line or trunk. It usually serves as a test point between in-house and outside plant cabling.

Main (or Standby Units) - Units that are operationally critical and are redundantly integrated into the system to achieve a high degree of reliability.

Maintenance Position - The VTABS maintenance workstation (also see Ancillary Position).

MALF - Malfunction signal from BUEC.

Man/Machine Interface - (Pertaining to station control and data acquisition). The operator contact with equipment governed by ANSI IEEE C37. MIL-STD-1472 is recommended as a reference for use in the design and evaluation of the man/machine interface.

Manual Ring - A selective signaling arrangement that consists of a manual ring, generated by the calling party, to alert a specific station on a multidrop circuit in which all stations receive the ringing signal.

Map - To establish a correspondence between the elements of one set and the elements of another set. A correspondence set between elements of one set and elements of another.

Mean Talker Level - Specified at -13.9 dBm0, which is 0.9 dBm less than the maximum voice frequency (VF) signal (average more than 3 seconds) on a standard VF channel and 2.1 dBm more than the VF channel interface standard.

Meet-Me Conference - A conference call in which parties desiring to enter a (pre-arranged) conference call do so by individually accessing the conference feature (e.g., a conference bridge).

Mode - A possible, customary, or preferred way of doing something.

Modular - The extent to which hardware/software is composed of discrete components such that a change to one component has minimal impact on other components.

Module - A limited aggregate of LRUs, data, and contiguous codes that performs independent functions. Typically, modules are used repeatedly in the construction of the system.

Monitor - To listen in on the communications of another controller.

Multiple - Providing more than one connection at a common point.

Multi-Point Trunk - A dedicated trunk shared by three or more positions at two or more facilities.

Multi-Position Sector - A sector whose control involves the use of more than one common console; typically, it will use two or three adjacent consoles.

Muting - The capability to eliminate receiver output volume on selected air/ground channels.

Muting, Local - See Local Muting.

Muting, Remote - See Remote Muting.

Nonlatching - A feature which either is or emulates a push-button that requires an operator to provide continuous touch action to maintain the desired push-button activation. The activation is terminated by the release of touch action on the push-button.

Off-Hook - One of several line/trunk supervisory signals. Normally a line/trunk state change of idle-to-off indicates a request for service.

Off-Line -

a. An operating condition wherein human action is required between the original recording functions (data recording and storage) and the ultimate data processing functions, including conversion operations, and loading/unloading operations incident to the use of point-to-point or data gathering systems.

b. The operations of a functional unit that are not under the continuous or automatic control of a central or main processing unit.

On-Line -

a. An operating condition wherein input data enters the system directly from the point of origin or in which output data is transmitted directly to where it is used.

b. The operations of a functional unit that are under continuous control of a central or main processing unit.

Operational Configuration - Hardware, communications, functional assignments, and connectivity currently in effect in VTABS.

Operating Position - A manned active position.

Operational Position - A position defined within a configuration.

Outlier - Data point which is not typical of the rest of the data; it may lie three or four standard deviations or further from the mean of the sample.

Outpulsing - Pulsing from a sender.

Override (OVR) - A switch provided call feature whereby a call being placed results in connection to the called party, even if the called position has an active call in progress.

PABX (Private Automatic Branch Exchange) - A private automatic telephone switching system that provides for transmission of calls to and from the public switch telephone network, and private switched or dedicated telephone networks.

Partial Failure - Failure resulting from deviation in characteristics beyond specified limits, but not such as to cause complete lack of the required function.

Physical Console - A specific physical device and/or workstation which includes a set of VTABS console equipment. Examples include an M-1 console, a common console, and the VTABS supervisory workstation. Each physical console has a unique physical console identifier.

Physical Console Assignment Mapping - A correspondence of logical console identifiers to physical console identifiers. The correspondence is such that only one physical console identifier is associated with a logical console identifier.

Physical Console Identifier - A site adaptable alphanumeric string of up to 4 characters which uniquely identifies a specific physical console. Each physical console has a unique console identifier. From its physical console identifier, the precise location of a physical console can be determined.

Physical Map - A correspondence set of the functional and physical characteristics of VTABS hardware.

Position - A location or piece of equipment at which a person works, e.g., that portion of a sector suite that is normally provided for the use of one ATC person. An M-1 or a common console configured for an air traffic control or ancillary activity.

Position Equipment - The position equipment consists of all VSCS equipment mounted in the console as well as the associated position logic, including its power supply (also see Common Console).

Position Electronics Module - The VTABS position electronics equipment that provides the control of the position equipment in a console in the event of a VSCS power failure, or in the position equipment in the DYSIM.

Position-Level Reconfiguration - A change of assignments and control capabilities wherein the modification or changeover occurs with respect to position maps.

Position Map - A correspondence set wherein the communications assignments and functional capabilities of a single position are defined. A correspondence set between the physical map and a configuration map for a single position (also see Switch Map).

Position Roll-In - Combining of communications assignments and functional capabilities required to control a sector at one or more positions of a sector suite.

Position Roll-Out - Distributing communications assignments and functional capabilities required to control a sector among positions of a sector suite.

Preempt -

a. The disconnection and subsequent reuse of part or all of an established connection of lower priority origins by a higher priority source.

b. Jack module preemption is disconnection and subsequent reuse of all the pre-established connections at a position.

c. PTT preemption by frequency classmark is disconnection and subsequent reuse of part of the established connection(s) for use of the frequency.

Preemption Capability - Ability to take over all existing communications channels.

Preset Conference - Same as progressive conference except that conferees will be called automatically by the system when the conference call is requested.

Program Control - The interaction between the software and the hardware of the switching system which determines the time and sequence in which processing occurs. The relationship between a set of instructions and the electronics incorporated into the design of the switching system which enables that system to recognize and perform tasks by interactive user commands or without further intervention by a system user.

Progressive Conference - A conference call in which conferees are successively added to the conference, up to the conference limit, at the discretion of a calling party.

Prototype System - A pre-production model.

PTT Lockout - Condition arising when an attempt is made to transmit on a frequency that is already being used. Transmission will not be permitted to the attempting position unless PTT preemption has been for that frequency.

PTT Preemption - A classmarked capability for a frequency at a position whereby PTT activation from that position will cause seizing of the frequency, locking out all other attempted users including the user just previous to PTT (preemption) activation.

Pulsing - The signaling over the communication path of signals representing one or more address digits required to set up a call.

Push-button Action or Push-button Operation - The selection of an operation, function, or process by pressing or touching a function key or some display group representing a function key. Push-button operation, although in existing equipment refers to the operation of a mechanical switch, has a broader meaning to include such state-of-the-art controls as touch membrane, capacitance touch, touch-entry standards and to meet the reliability/ maintainability requirements of this document.

Push-to-Talk (PTT) - A method of communication over a speech channel in which transmission occurs in only one direction at a time; while talking the talker is required to keep a switch activated (continuous touch action).

Radio Transfer (R/T) Switch - The R/T switch (when enabled) will route all incoming A/G voice to the loudspeaker and suspend current voice monitors regardless of frequency voice routing settings and auto voice routing.

Real Time Quality Control (RTQC) - Real time quality control is the on-line capability of fault detection, isolation, and reporting in real time.

Receiver - Equipment that picks up radio signals sent by transmitters.

Reconfiguration - A change of communication assignments and control capabilities through the modification of the invoked configuration map or through a changeover from one map to another. Reconfiguration can take place at the position, sector, area, and facility levels.

Remote Override - The capability to provide override between two independent systems, VTABS to/from TCS.

Remote Muting - Muting of receivers for selected frequencies. The VTABS will not receive from the radio interfaces for frequencies on which the remote muting function has been activated.

Resectorization - Redefining and restructuring sectors and the creation of new sectors to support the establishment of new airways and changing traffic patterns.

Return Loss - The return loss at an impedance discontinuity on a two-wire line is the ratio, expressed in decibels, of the level of incident signal to that of its reflected signal. The return loss on a four-wire line is the insertion loss measured between transit and receive pairs with the far end terminated as specified. Echo return loss is a weighted average (on a power basis) of the return loss at all frequencies in the range 500 to 2500 Hz. Single-frequency return loss is the lowest non-weighted return loss in the 0.2 to 3.2 KHz band.

Ringback - A tone that indicates to a caller that a ringing signal is being applied to a called station.

Sector - A volume of airspace, bounded by a series of connected line segments with altitudes defined for the purpose of assigning responsibility for control of aircraft in the airspace (also see Control Sector).

Sector Airspace - One or more contiguous fix posting areas (FPAs) controlled from a single control sector (i.e., the FPAs assigned to a control sector). The sector airspace may overlie or underlie airspace controlled by another sector.

Sector Area - See Sector Airspace.

Sector Combining - Combining of more than one sector's communications assignments and functional capabilities at one or more sector suites.

Sector Decombining - Distributing of combined sector communications assignments and functional capabilities among sector suites.

Sector-Level Reconfiguration - A change of ATC communications assignments and control capabilities wherein the modification or changeover occurs with respect to sector maps.

Sector Map - A correspondence set wherein the communications assignments and functional capabilities of all positions in a sector suite are defined. A correspondence set between the physical maps and the configuration maps of all positions in a sector suite (also see Switch Map).

Sector Suite - A collocated set of one to four common consoles equipped with appropriate sets of data entry and display devices. The set is assigned to one or more controllers working a control sector.

Sector Suite Common Console - Physically identical position workstations within a sector suite which contain the VTABS common console equipment as a primary component.

Select - An action at an ATC or ancillary position touch entry device or interactive display which results in the activation of an A/G communication connectivity at that position.

Selected Frequency - One of an air traffic controller's assigned frequencies which the position operator has indicated will be included in the set of currently operational frequencies to be used for transmission and reception at the position. Connectivity of the transmitter and receiver has been confirmed.

Selective Mode Operation - In this mode, a VHF and UHF assigned to a sector are combined on one trunk. The controller may select VHF only, UHF only, or select both frequencies simultaneously. Using this system, a controller keying one frequency (VHF or UHF) denies the other frequency (UHF or VHF, respectively) to another controller.

Sender - Equipment that generates and transmits signals in response to information received from another part of the system.

Service Circuits - Those time-shared circuits of the system which achieve a desired grade of service. The failure of one or several will not make the system inoperative, but may degrade the service during peak load.

Service F - A communications service comprised of dedicated circuits leased by the FAA.

Sidetone - The acoustic signal resulting from a portion of the transmitted signal being coupled to the receiver.

Single Point Failure - A failure of a single item which has the effect of failing an entire function or functionality.

Signaling - With respect to telephone switching systems; the transmission of address and other switching information between stations and central offices, stations and switching entities, and between switching entities.

Site - Any location where equipment is to be supplied or installed.

Sound Pressure Level (SPL) - An acoustical intensity expressed in decibels above a reference level of 0.0002 dyne/cm^2.

Split Mode Operation - The VHF and UHF frequencies of the sector are carried on two different trunks. Thus, there is no contention; PTT lockout affects only the selected frequency.

Standard - Regularly and widely used, available, or supplied; definite rule for measurement of quantity, weight, extent, value, or quality as established by authority.

Subassembly - Two or more parts that form a portion of an assembly or a unit replaceable as a whole, but having part or parts that are individually replaceable.

Subsystem - A combination of sets, groups, etc., that performs an operational function within a system and is a major subdivision of the system.

Sudden Failure - Failure that could not be anticipated by prior examination or monitoring.

Supervisory Position - The workstation for first line supervisor who is typically responsible for less than eight sectors (also see Ancillary Position).

Support Position - The workstation for personnel supporting air traffic control (also see Ancillary Position).

Switch Map - That portion of a position, sector, area, and facility map that provides the correspondence between the logical connectivities and the physical connectivities within a configuration.

System - The equipment, hardware/software or subsets of two that fulfill the functional requirements of this document.

Support Functions - All functions not listed in Table VI, 3.2.3.1, are support functions for availability considerations.

System-Generated A/G PTT - An A/G PTT signal initiated by the system to support cross-coupling, weather broadcast, and emergency frequency broadcast.

Tactical Special Use Frequency - Each area is assigned one UHF frequency allowing military planes (typically high-performance planes) to change their communication frequency only upon entering a new area as opposed to a new sector.

Telephone Position Circuit - All circuitry required to permit the telephone instrument or headset to access all voice transmission paths terminating at the position.

Transmission Level Point - A signal-measuring point, defined during the transmission system design, where a signal level is specified in relative, but not absolute, terms. 0TLP refers to the zero transmission level point which, in contemporary design practices, is an arbitrary reference along a transmission path. The transmission level at any other point is the nominal design gain (or loss) in decibels relative to zero transmission level at 1.0 KHz. The VTABS 0TLP will be defined by the contractor; the zero transmission level is specified as 0 dBm at 1.0 KHz.

Transmitter - Equipment that sends radio signals to the outside world; these signals are picked up by receivers.

Trunk - A communication channel between two switching systems. A two-wire or four-wire circuit that can be a leased or a Government-owned transmission facility connecting the VTABS with external or remote equipment. The trunk will normally include the protection and isolation equipment when leased facilities are used. A trunk is switch-connected at both ends.

Trunk Circuit - The circuitry being controlled by the VTABS to directly connect with another switching system.

Trunk Group - A number of trunks that can be used interchangeably between two or more switching systems.

Trunk Multi-Point - A dedicated trunk that is shared by three or more positions, at two or more facilities.

Turnkey - Complete single responsibility from start to the point of turning over the final system, ready for operational use.

Type - A particular kind, class, or group.

Type Test - Tests performed to verify that the equipment or system performs over the range of specified service conditions.

Unit - An assembly or any combination of parts, subassemblies, and assemblies mounted together, normally capable of independent operation in a variety of situations.

Utility Program - A computer program in general support of the processes, of computer, e.g., loading, sorting, trace routines, or copying data from one storage device to another.

Voice Call - A call mode wherein initial circuit connectivity is always to the loudspeaker at the called position. Prior to answering, the called party must switch the connection (single touch action) to his or her headset. Voice calling is an overlay mode, that is, it can be used in conjunction with direct access or indirect access modes. Also known as group alerting.

Voice Call Circuit - A special connectivity path for processing voice calls to selected loudspeakers.

VSCS Console Equipment - The complement of VTABS position equipment consisting of the VTABS position equipment consisting of the VTABS position electronics box, the indirect access keypad and interactive display unit(s) (panel(s)).

VSCS Interactive Display Panel - A physical device that provides display and control access to the user.

VSCS Numbering Plan - A uniform numbering system wherein all positions with VTABS display panels in an ARTCC have unique designations similar in form to those of all other ARTCCs connected to the NAS Integrated Communication System.

VTABS Power Outage - The total loss of power to the VTABS of no more than 20 minutes.

WINKING - A visual signal interrupted 60 times per minute with a 95:5 on:off ratio.

Zip Tone - A 0.2-second burst of dial tone.

6.3 RMA DEFINITIONS

Inherent Availability, A_i - a measure (probability) of the degree to which an item (system) is in an operable and committable state at the start of a mission, when the mission is called for at an unknown (random) time.

$$A_i = \frac{MTBCF_s}{MTBCF_s + MTTR_s}$$

where:

A_i = inherent (designed in) availability
$MTBCF_s$ = mean time between critical failures for the system
$MTTR_s$ = mean time to repair for the system

Operational Availability, A_o - The proportion of time a system is either operating or is capable of operating, when used in a specific manner in a typical maintenance and supply environment. This definition of availability is suitable for defining logistics design goals and scoring methods in field trails. There are two forms of this logistic measurement model shown below; the VTABS analysis should use the form given in (b).

a. The theoretical model, for an ideal reporting environment where all records are kept for all needed measurements, is given as:

$$A_o = \frac{\text{All time when system is operable or operating}}{\text{Total calendar time that readiness was required of a system under control of the operating organization (or possessed time)}}$$

$$= \frac{OT + ST}{OT + ST + TCM + TPM + TALDT}$$

where

OT = total operating time (unit hours) per system
ST = standby time (system is operational, but not in use)
TCM = total corrective maintenance time per system (including diagnostics)
TPM = total preventive maintenance time
TALDT = total administrative and logistics delay time

b. The more realistic version for operational availability is given below:

$$A_o = \frac{\text{Total Possessed Time - Total Down Time}}{\text{Total Possessed Time}} = \frac{\text{TPT - TDT}}{\text{TPT}}$$

or simply

$$A_o = \frac{\text{Total Up Time}}{\text{Total Possessed Time}} = \frac{\text{TUT}}{\text{TPT}}$$

Maintainability - The ability of an item to be retained in or restored to specified conditions when maintenance is performed by personnel having specified skill levels, using prescribed procedures and resources, at each prescribed level of maintenance and repair.

Mean Bench Repair Time (MBRT) - The average time for off-line diagnostics and repair, independent of logistic and administrative delays.

Mean Time Between Failures (MTBF) - The average time between failures of an equipment or item.

$$\text{MTBF} = \frac{\text{Total operating time for all items of a kind}}{\text{Total number of failures for the same items}}$$

Mean Time Between Critical Failures (MTBCF) - The average time between mission failures.

$$\text{MTBCF} = \frac{\text{Total operating time}}{\text{Number of mission failures}}$$

Mean Time Between Preventive Maintenance Actions (MTBPMA) - The average time between scheduled preventive maintenance actions.

Mean Time Between Unscheduled Maintenance Actions (MTBUMA) - The average time between failures, when all system elements, including redundant elements, are considered single string and end to end, for reliability parameter (MTBUMA) estimation.

Mean Time To Repair (MTTR) - The average time required to restore a failed equipment or item exclusive of logistic and administrative delay times.

$$\text{MTTR} = \frac{\text{Total corrective maintenance time for all items of a kind}}{\text{Total number of failures for the same items}}$$

Mean Time To Repair for the System, MTTR(s) - The sum of the weighted mean times to repair for the individual items divided by the sum of the individual item failure rates.

$$MTTR(s) = \frac{\text{lambda(1) MTTR(1) + ... + lambda(n) MTTR(n)}}{\text{lambda(1) + ... + lambda(n)}}$$

Reliability - The probability that an item can perform its intended function for a specified interval under stated conditions.

Single-Point Failure - a failure of a single item that has the effect of failing an entire functionality.

6.4 SYSTEM FAILURE

Operational Mission Failure (Critical Failure) - Any incident or malfunction of the system, excluding software defects, which the ATC controller/ maintenance crew cannot remedy or repair or reconfigure using the controls, authorized test equipment and tools within a specified time, and which causes one or more of the following:

a. Inability to continue, commence, or cease operation,

b. Inability to accomplish any of the mission-essential functions.

c. Loss of any process essential to any function even though not essential to the specific mission in progress.

d. a critical or catastrophic hazard to personnel or equipment as defined by MIL-STD-882A.

e. Loss of mission-essential functions caused by improper operating or maintenance instructions or inadequate test, measurement and diagnostic equipment (TMDE) or support equipment.

Unscheduled Maintenance Actions - Any malfunction which is either an operational mission failure or results in any unscheduled corrective maintenance action. All operational mission failures are considered unscheduled maintenance actions even if negligible time is actually required for corrective maintenance.

Mission Essential Functions - Functions that the system must be capable of performing in order to accomplish its mission tasks in an acceptable manner.

Equipment or Item - Equipment or item failure is when any part of an item does not perform as required by its performance specification after it has been installed and determined to be operable prior to the event.

Preventive Maintenance (PM) - All actions performed in an attempt to retain an item in a specified condition by providing systematic inspection, detection, and prevention of incipient failures. Preventive Maintenance is synonymous to Periodic Maintenance.

a. System non-interrupting PM -- PM that does not degrade system operational effectiveness,
b. System interrupting PM -- PM that degrades system operational effectiveness.

Corrective Maintenance - All actions performed as a result of failure, to restore an item to a specified condition.

ADDENDUM 1

This addendum to the VTABS Specification gives the requirements for additional features and functionality that will be implemented following FAA delivery request. The additional requirements are listed in the applicable paragraphs of the VTABS Specification as contained in this Addendum 1.

3.9.8.2.1 Reserve Power Charge Status - The VTABS shall provide the charge status of the reserve power system to the System Monitor and Control Subsystem. This charge status shall be the individual battery string voltage of the reserve power system. The charge status will be sent to the Control Subsystem over a RS-232 serial interface and be reported and displayed at the maintenance and NAS Manager positions.

SPECIFICATION CHANGE NOTICE (SCN)

1. Originator Name and Address	2. Status	3. Code Ident	4. Document No.
Federal Aviation Administration Advanced Automation Program 800 Independence Avenue, S.W. Washington, D.C. 20591	Approved		FAA-E-2914
		5. Code Ident	6. SCN No.
			SCN-PSR-003

7. System Designation

8. Related ECR/DCR No.	9. Contract No.	10. Contractual Activity
DCR-VTABS-004, 005 and 006	DTFA01-92-D-00004	

11. Configuration Item Nomenclature	12. Effectivity

This notice informs recipients that the document identified by the number (and revision letter) shown in block 4 has been changed. The pages changed by this SCN (being furnished herewith) carry the same date as this SCN. The page numbers and dates listed below in the summary of changed pages, combined with nonlisted pages of the original issue of the revision shown in block 4 constitute the current version of this document.

13. SCN No.	14. Pages Changed (indicate Decisions)	S*	A*	15. Date
SCN-PSR-003	Cover (Blank on Reverse)	X		08/05/98
SCN-PSR-003	i - xii	X		08/05/98
SCN-PSR-001	23			07/03/97
SCN-PSR-003	24 - 41	X		08/05/98
ORIGINAL	42			01/15/97
SCN-PSR-003	43	X		08/05/98
ORIGINAL	44			01/15/97
ORIGINAL	45			01/15/97
SCN-PSR-003	46	X		08/05/98
SCN-PSR-003	53	X		08/05/98
SCN-PSR-002	54			10/30/97
SCN-PSR-003	55 - 70	X		08/05/98

16. Technical Concurrence	17. Date

S* - Indicates Supersedes Earlier Page A* - Indicates Added Page